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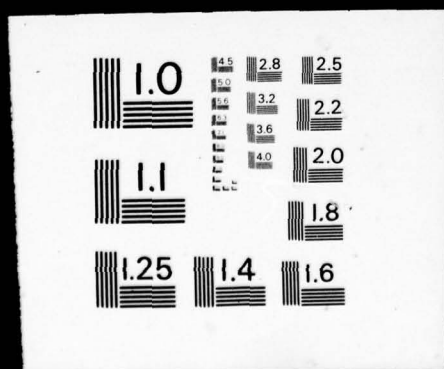
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PATTERN ANALYSIS AND RECOGNITION CORP ROME N Y
THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM --ETC(U)
SEP 76 P K SANYAL, C BERSTER, T MCGIBBON F30602-72-C-0193
PAR-76-6 RADC-TR-76-224-VOL-2 NL



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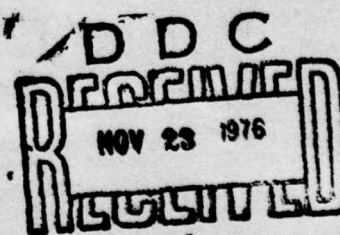
RADC-TR-76-224, Vol II (of four)
Final Technical Report
September 1976



AD A032305

THE WAVEFORM PROCESSING SYSTEM
User's Manual for the Waveform Processing System
Pattern Analysis and Recognition Corporation

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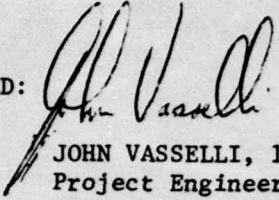


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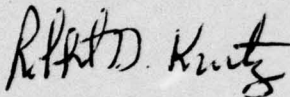
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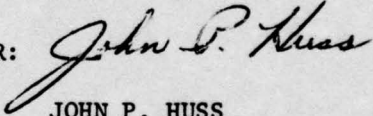

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ABSTRACT

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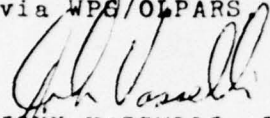
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Evaluation

This work represents the partial results of the three year development of the Waveform Processing System (WPS) under Contract F30602-72-C-0193. The user's manual will be the most referenced document delivered under this contract since it will literally be the tool by which all individuals will learn of and utilize the full potential of the PDP-11/45 WPS/OLPARS computer system. This manual is therefore the key to the future development and use of automatic feature definition, extraction and classification software generated via WPS/OLPARS.


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SECTION 1

INTRODUCTION

1. INTRODUCTION

The Waveform Processing System (WPS) has been developed by Pattern Analysis And Recognition Corporation for the Rome Air Development Center under contract F30602-72-C-0193. WPS is a large, interactive, graphics oriented system offering the complete capability of (1) performing mathematical and editing operations on waveform data, (2) extracting feature vectors from the waveforms by means of an on-line language, and (3) analyzing feature vector data and developing pattern classification logic. Thus, WPS allows the user to accept waveform data (radar signatures, voice prints, electro-cardiograms etc.) and to develop classification logic, which can then be implemented in hardware/ firmware for field application. The user can refer to Volume I of the final report for a complete technical description of WPS.

1.1. HARDWARE

The Waveform Processing System runs on a DEC PDP 11/45 with 68K core. The Disk Operating System (DOS-V08) was used for the WPS software development. Supporting hardware includes: (see Figure 1-1, pg. 1-2)

- o PDP 11/45 Central Processor Unit
- o Floating Point Processor
- o Standard Keyboard Interface
- o Vector General Display Unit with
 - oo Keyboard
 - oo Light Pen
 - oo Function Keys
 - oo Dials
 - oo Data Tablet
- o TEKTRONIX Hardcopy Unit
- o Floating Head - removable disk packs
 - oo RK05
 - oo RP02 or RP04
- o Two 9-track magnetic tape units

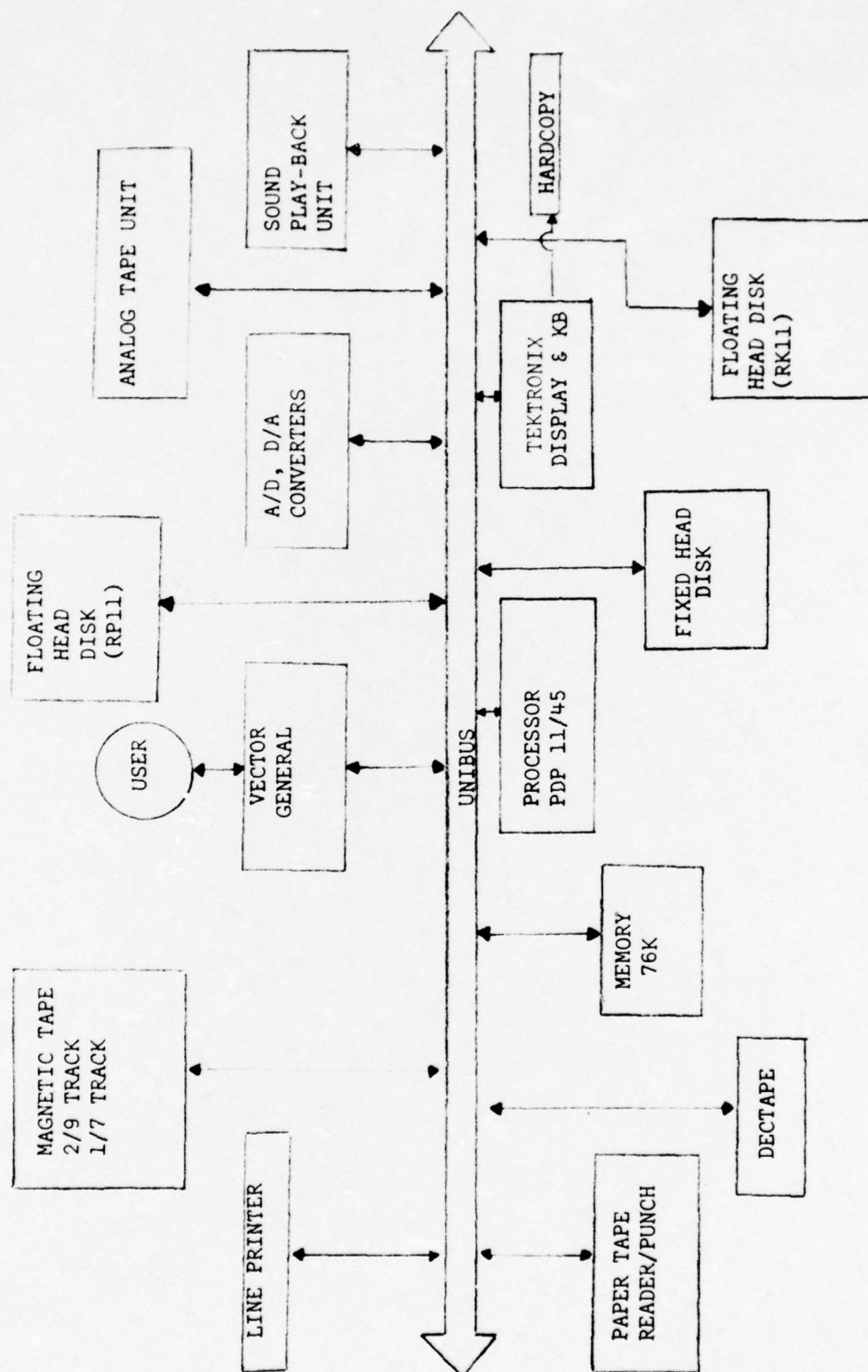


Figure 1-1 The Hardware Layout for WPS

Additional equipment for acoustic waveform analysis includes:

- o AD/5 analog computer (D/A converter included)
- o Patch Panel, audio amplifier with loudspeaker or headphone set.

1.2. VG DISPLAY FORMAT

The "initial frame" of WPS appears in the "menu region" of the Vector General display. The organization of the display screen is shown in Figure 1-2, on page 1-4a.

The General Purpose (GP) region is available for displaying any type of visual information such as waveforms, their frequency transform, etc. This area allows the display of approximately 5500 points.

The communications region contains instructions to the user and the user's responses. Some options, when selected, request the input of various parameters and the user types them in through the keyboard.

Hardcopies of data displayed in the GP region can be obtained via the hardcopy unit, in association with the Tektronix display unit.

1.3. EXECUTING WPS OPTIONS

All options in WPS are organized into "menu frames". Each frame can have up to 16 options, numbered from 00 to 15, all of which are not necessarily implemented. There are 16 keys (or light buttons) on the "function keyboard", which correspond to the 16 options in the menu displayed. If a particular option is not implemented, that light button remains unlighted.

The user selects an option by depressing the appropriately numbered "key", followed by the "interrupt" key. Some options simply deliver other menu frames; hence, the user can go on to still other frames. Thus, to arrive at a frame, he may have to press several numbers in sequence. There is usually no unique sequence, but the shortest sequence from the initial frame is established as the "calling sequence" for the particular frame.

1.3.1. Special Control Characters

The following control characters may be used:

- † X escape from current option and return to menu.
 - † T exit WPS and deliver DOS.
 - † W hardcopy.
- († stands for the CNTRL key)

1.3.2. Error Messages And Error Recovery

The system has been designed to be foolproof to a large degree. When the user makes a mistake in typing in the required parameters, e.g. a non-existent tree name, the system usually responds with an error message and asks for the input again. In other situations, an error message is given and control is returned to the WPS executive. Whenever control is returned to the executive, the communication "SELECT LIGHT BUTTON" is displayed in the communication region.

Some errors have been referred to as being fatal in this manual. They are fatal only in the sense that the error prevents the complete execution of an option. In this case, control is returned to the executive, and the user is free to select the same option again or go on to other options.

If at some time the screen goes blank or the button on the function box seems to be inoperative, the user should report it to the maintenance personnel.

1.4. ORGANIZATION OF THIS MANUAL

The manual is divided into thirty eight sections and four appendices.

This section (Section 1) contains a brief overall description of WPS.

The remaining 37 sections are devoted to the 37 WPS "frames." Section 2-6 describe frames that are applicable to waveform data as well as vector data.

Sections 7-18 describe frames applicable to only waveform data.

Section 19 describes the PARLAN language, which was specially developed to extract feature vectors from waveforms.

Section 20-38 are the so-called OLPAR frames and apply strictly to vector data.

Each section describes one frame only, and except for options that are common to many frames, each section is complete by itself. At the beginning of each section, there is a brief general description of the frame and of the list of options in that frame. The description of each option starts on a fresh page.

The starting page includes the frame name at the top left and the frame calling sequence at the top right. Immediately below the frame name are the option number and the option name as they appear in the menu. The description includes a general description, the man-machine dialogue, and the error messages.

The dialogue, if any, lists alternately the system and user responses, each identified appropriately. Also, the messages and queries that are part of the system response are printed in capitals and enclosed within < >. In

certain cases, retracing or skipping part of the dialogue has to be indicated. For those cases only, labelings, e.g. S1, S2 etc., have been used. The labelings are entirely local for each option.

Not all the frames have all 16 possible options implemented. Thus, some of the light-button numbers on the VG screen have blanks next to them. In the manual, the word "blank" has been printed where actually a blank appears on the screen.

Some of the options are not yet functional, though the names appear on the menus. The absence of an "X" against these names in the "status" column means that these options are not functional. In other places, the label "NOT IMPLEMENTED" has been employed.

Appendix A gives the instruction sequence for getting WPS on the air.

Appendix B gives the WPS format for waveform data. Data must be available in this format to be loaded into WPS.

Appendix C lists the various data type numbers used in WPS.

Appendix D gives the WPS format for vector data.

1.5. WPS FRAMES AND OPTIONS

The following two pages list the WPS frames with their descriptive names and call sequences.

Figure 1-3 on pages 1-5b and 1-5c gives the control tree for WPS. Note that the tree has been drawn based on the call sequence of the frames and does not indicate the only path to a frame.

On pages 1-6 to 1-42 are the menu of options in the individual frames, ordered according to their call sequence numbers. An "X" against an option indicates that the option is fully functional; otherwise the option is planned to be made available in the near future. The word "blank" has been used to indicate that these light button numbers are open and may be used to implement additional options. Note that when the menu is displayed on the VG, an actual blank space, rather than the word "blank", appears.

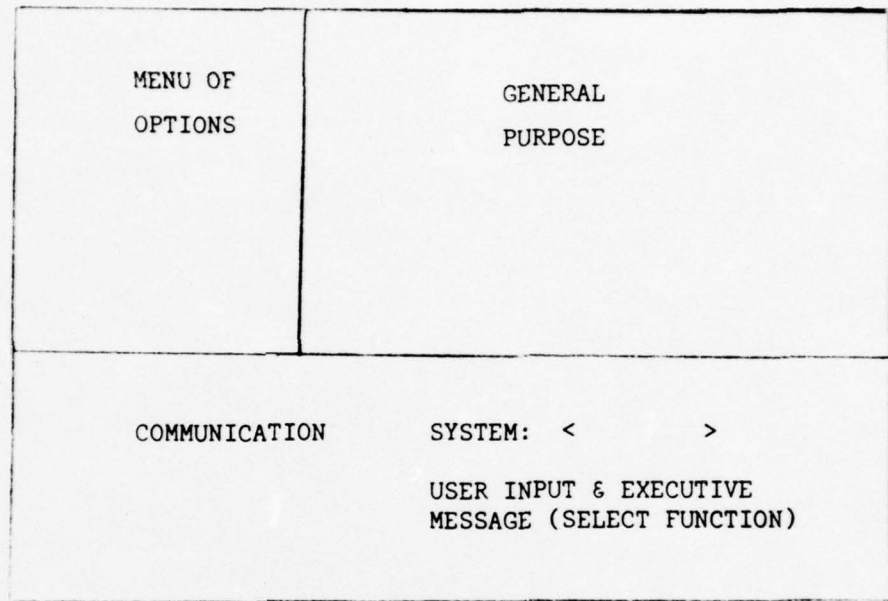


FIGURE 1-2 DISPLAY SCREEN ORGANIZATION
(REGIONS NOT DRAWN TO SCALE)

WPS FRAMES AND OPTIONS

<u>SECTION #</u>	<u>DESCRIPTIVE NAME</u>	<u>WPS NAME</u>	<u>CALL SEQUENCE</u>
2	INITIAL FRAME	FRAME 1	
3	INPUT DATA FRAME	INPDTA	01
4	TREE MANIPULATIONS FRAME	SYSUT	02
5	STATISTICAL TABULATION FRAME	STATAB	06
6	OUTPUT DATA FRAME	IOPRNT	07
7	WPS FRAME	FUNCT	08
8	SINGLE DISPLAY FRAME	SINGLE	08-00
9	EXTENDED OPTIONS FRAME	EXTOPN	08-00-11
10	PLAY BACK	PLAYBK	08-00-11-08
11	EDIT FRAME	WVFEDT	08-00-12
12	MULTIPLE WAVE INITIAL FRAME	MINIT	08-01
13	MULTIPLE WAVE DISPLAY FRAME	MWVDSP	08-01-14
14	WAVE TO WAVE TRANSFORMATION FRAME	WAVE	08-02
15	SPECTRAL ANALYSIS FRAME	SPCTRM	08-02-01
16	ALGEBRAIC/CALCULUS FRAME	ALGCAL	08-02-02
17	ARITHMETIC FRAME	ARITHC	08-02-02-02
18	SEGMENTATION FRAME	SEGMENT	08-03
19	PARLAN FRAME	PARLAN	10

WPS FRAMES AND OPTIONS (CONTD.)

<u>SECTION #</u>	<u>DESCRIPTIVE NAME</u>	<u>WPS NAME</u>	<u>CALL SEQUENCE</u>
20.	INITIAL FRAME FOR OLPARS	OLPFRM	09
21.	STRUCTURE ANALYSIS FRAME	STRANL	09-00
22.	ONE SPACE PLOT FRAME	1SPACE	09-00-00
23.	TWO SPACE PLOT FRAME	2SPACE	09-00-00
24.	ZOOM OPTIONS	ZMOPTS	09-00-00-04
25.	MEASUREMENT EVALUATION FRAME	MEAEVL	09-01
26.	DISCRIMINANT MEASURE EVALUATION FRAME	DMFRM	09-01-00
27.	PROBABILITY OF CONFUSION INITIALIZATION FRAME	PCIFRM	09-01-00
28.	PROBABILITY OF CONFUSION EVALUATION FRAME	PCFRM	09-01-01-05
29.	TRANSFORMATION FRAME	TRNFRM	09-02
30.	DISTRIBUTION FREE LOGIC DESIGN FRAME	LOGDES	09-03
31.	CREATE LOGIC FRAME	CRELOG	09-03-00
32.	HISTOGRAM PLOT FRAME	DFHIST	09-03-00-00
33.	SCATTER PLOT FRAME	DFSCAT	09-03-00-00
34.	LOGIC EVALUATION FRAME	LOGEVL	09-03-01
35.	PAIRWISE MODIFICATION FRAME	PWMOD	09-03-02
36.	HISTOGRAM FOR FISHER PAIRWISE MODIFICATION FRAME	DFHFSH	09-03-02-01
37.	SCATTER PLOT FOR DISCRIM PLANE FOR PAIRWISE MODIFICATION	DFSDSP	09-03-02-02
38.	EDIT NAME AND SAVE FRAME	NASFRM	09-04

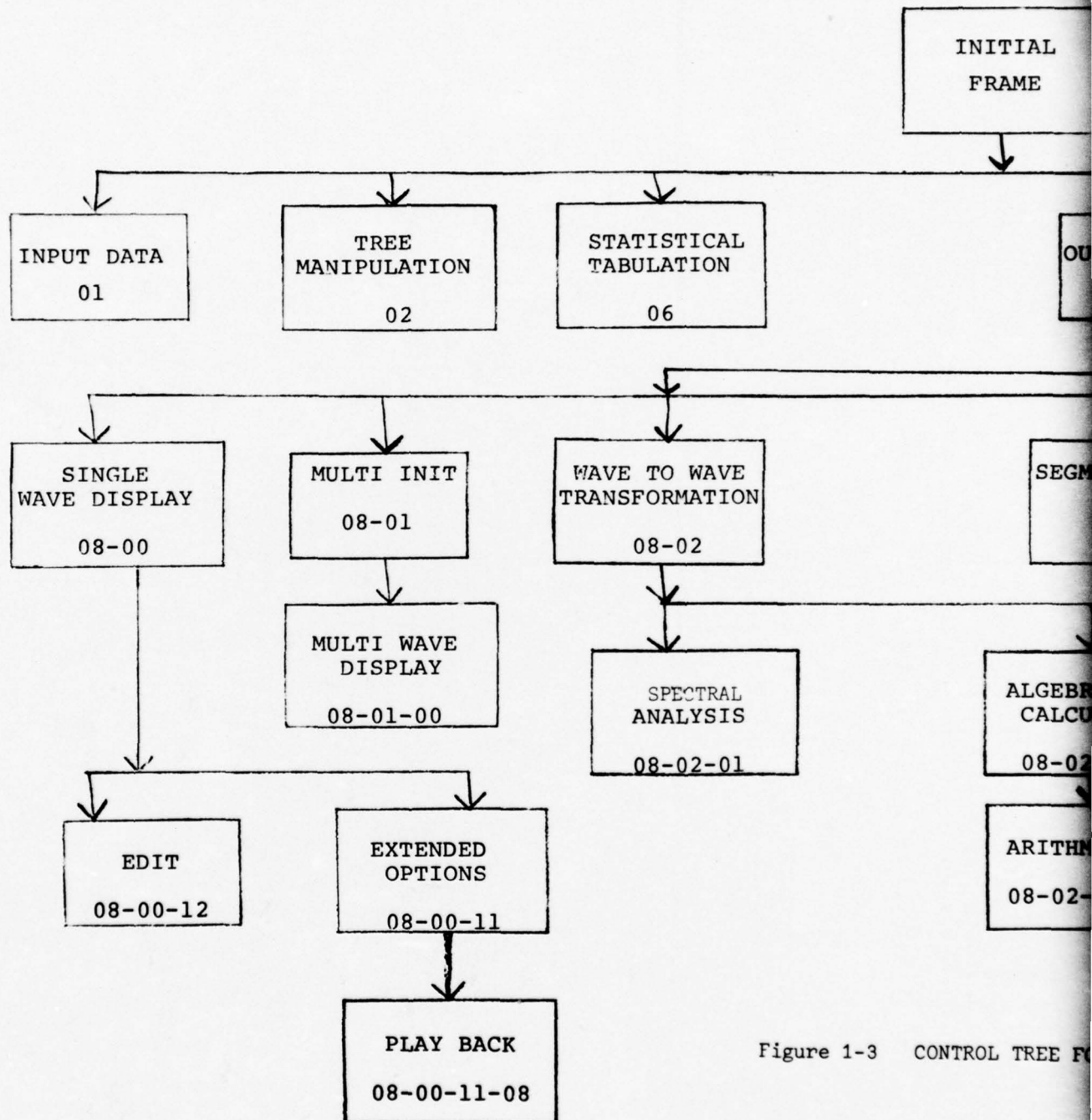


Figure 1-3 CONTROL TREE FOR

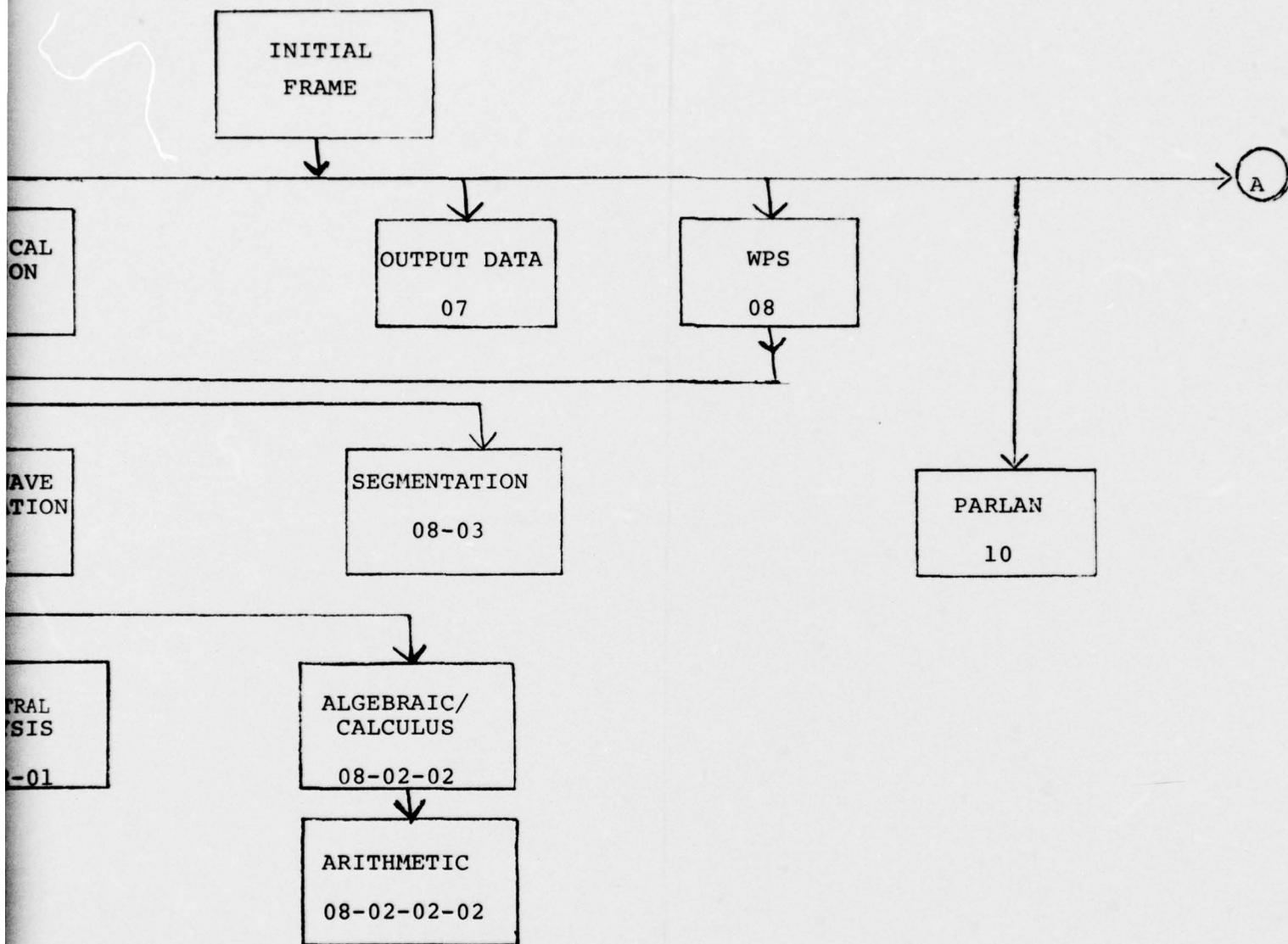
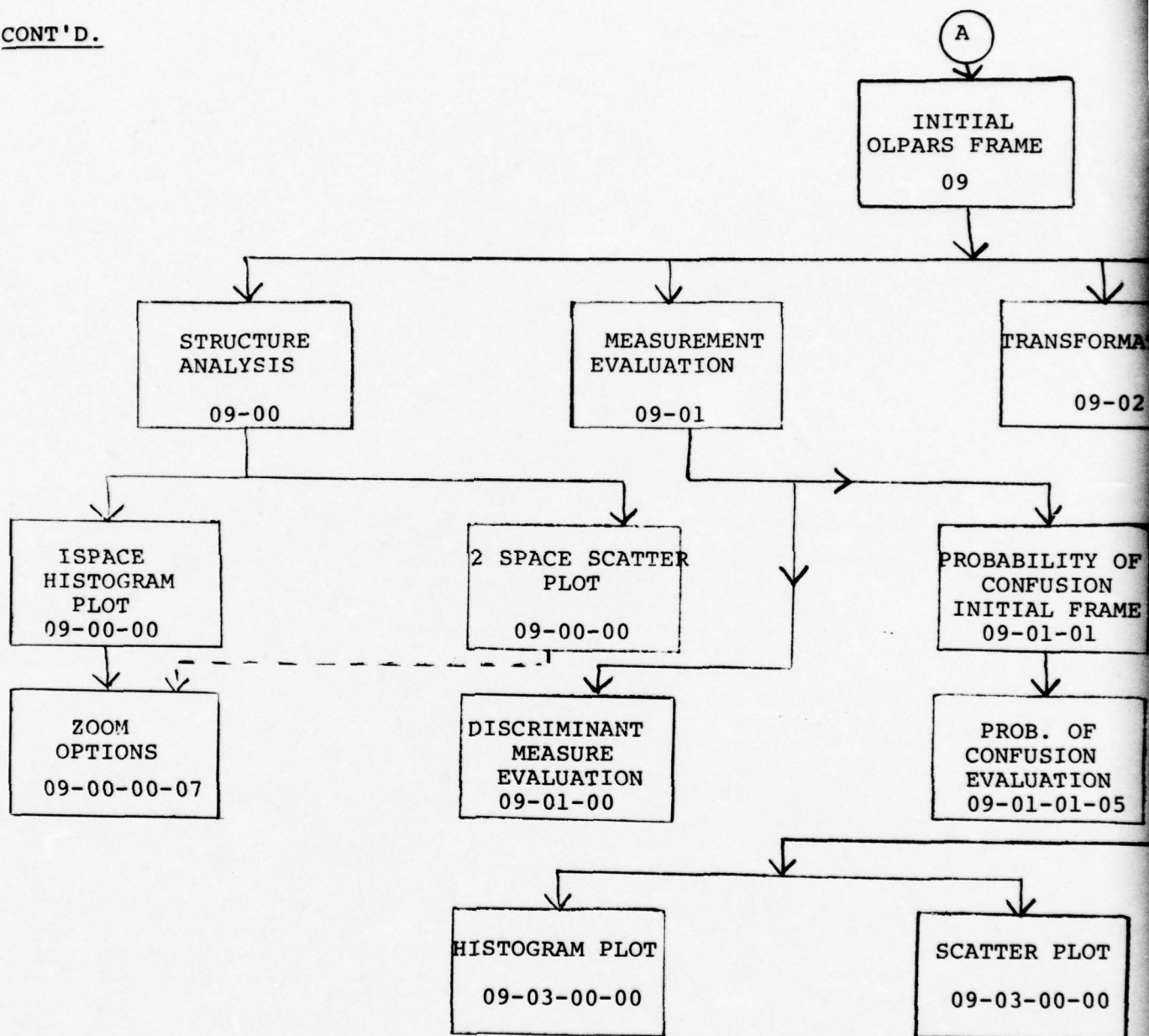


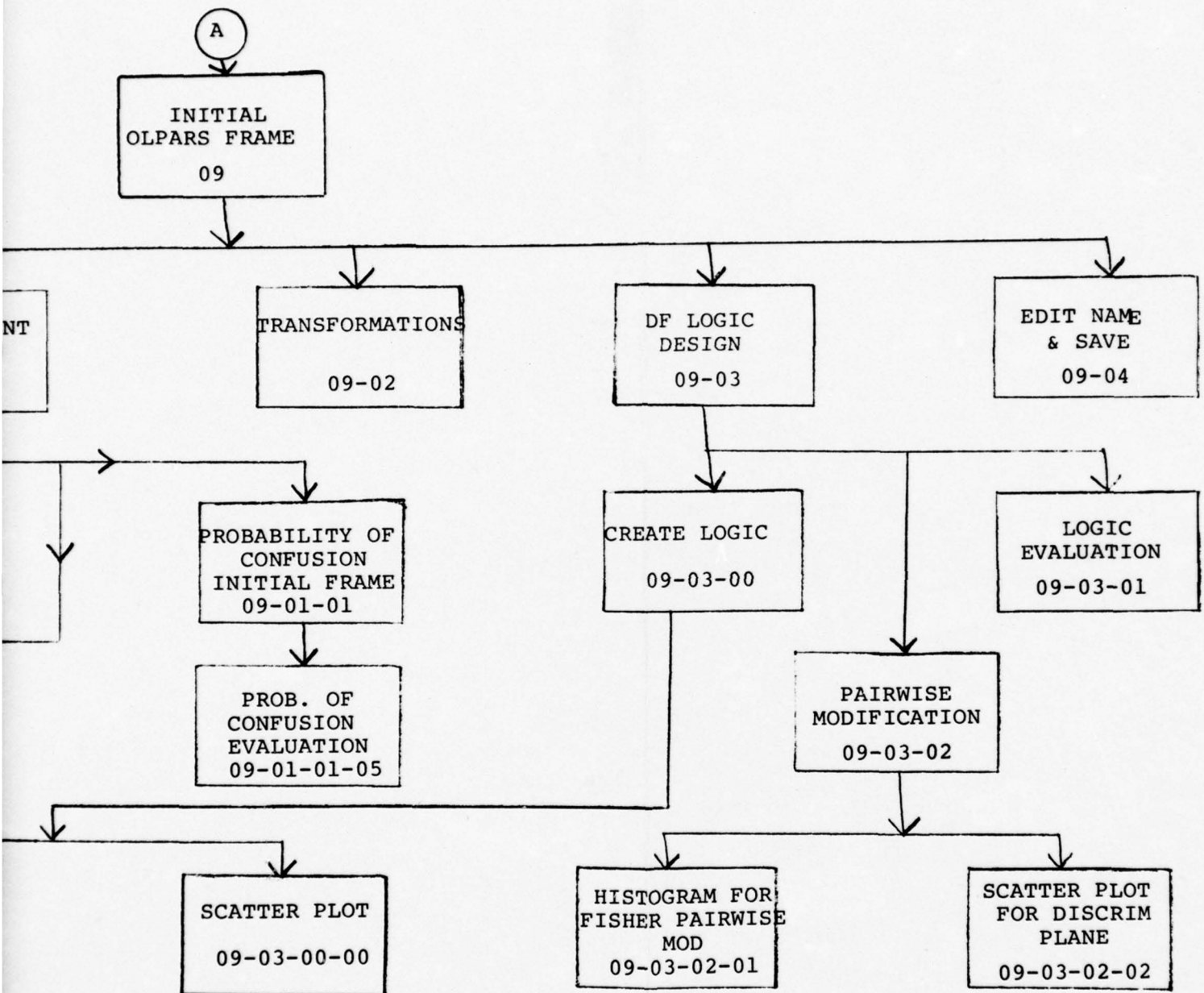
Figure 1-3 CONTROL TREE FOR THE WAVEFORM PROCESSING SYSTEM

CONT'D.



CONTROL TREE FOR THE WAVEFORM PROC

Figure 1-3 (Cont'd)



1-5c

FLOW TREE FOR THE WAVEFORM PROCESSING SYSTEM

Figure 1-3 (Cont'd)

2

INITIAL FRAME

FRAME 1

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	INITIALIZE		[Not Implemented]
01	INPUT DATA	X	3-1
02	TRE MANIPULATION	X	4-1
03	LIST DIRECTORY	X	4-00-01
04	LIST TREES	X	2-04-01
05	DRAW TREE	X	2-05-01
06	STATISTICAL TAB	X	5-1
07	OUTPUT DATA	X	6-1
08	WPS	X	7-1
09	OLPARS	X	20-1
10	PARLAN	X	19-1
11	(PROGRAM TEST X)	X	} For Program Development and Test. Not for user.
12	(PROGRAM TEST Y)	X	
13	(PROGRAM TEST Z)	X	
14	(blank)		
15	HARDCOPY	X	Not Described

INPUT DATA FRAME

FRAME NAME: INPDTA

CALLING SEQUENCE 01-

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	WAVE TAPE INPUT	X	3-00-01
01	VEC TAPE INPUT	X	
02	WAVE CARD INPUT	X	3-02-01
03	VEC CARD INPUT	X	
04	RES WAVE TREE	X	3-04-01
05	RES VECTOR TREE	X	
06	NAME AND SAVE		
07	MODIFY TREE TEXT	X	
08	INPUT LOGIC TREE	X	3-08-01
09	(blank)		
10	"		
11	LIST DIRECTORY	X	4-00-01
12	LIST TREES	X	2-04-01
13	DRAW TREE	X	2-05-01
14	RET TO INIT FRAME	X	2-1
15	HARD COPY	X	

TREE MANIPULATIONS FRAME

FRAME: SYSUT

CALLING SEQUENCE 02-

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	LIST DIRECTORY	X	4-00-01
01	LIST TREES	X	2-00-01
02	DRAW TREE	X	2-05-01
03	DELETE TREE	X	4-03-01
04	DELETE NODE	X	4-04-01
05	DELETE SUBSTRUCTURE	X	4-05-01
06	DELETE VECTOR(S)		
07	COMBINE NODES	X	4-07-01
08	CREATE TREE	X	4-08-01
09	APPEND NODES		
10	APPEND FEATURES		
11	SORT		
12	CREATE DATA SET		
13	SELECT DATA SET	X	8-13-01
14	RET TO INIT FRM	X	2-1
15	HARDCOPY	X	

STATISTICAL TABULATION FRAME

FRAME: STATAB

CALLING SEQUENCE 06-

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	VEC STATS	X	
01	DIF BETW MEANS	X	
02	COVARIANCE MATRIX	X	
03	CORRELATN MATRIX		
04	WAVE DATA MEAN		
05	WAVE DATA VAR		
06	WAVE MIN/MAX		
07	(blank)		
08	"		
09	"		
10	LIST TREES	X	2-04-01
11	SELECT DATA SET	X	8-13-01
12	DRAW TREE	X	2-05-01
13	(blank)		
14	RET TO INIT FRM	X	2-1
15	HARDCOPY	X	

OUTPUT DATA FRAME

FRAME: IOPRNT

CALLING SEQUENCE 07

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	PRINT DIRECTORY	X	6-00-01
01	PRINT TREES	X	6-01-01
02	PRINT TREE TABLE	X	6-02-01
03	PRINT HEADR INFO	X	6-03-01
04	PRINT WAVEFORM	X	6-04-01
05	PRINT VECTOR	X	6-05-01
06	PRINT TREE/NODE	X	6-06-01
07	PRINT IDS	X	6-07-01
08	OUTPUT WAVE TAPE	X	6-08-01
09	OUTPUT VEC TAPE	X	
10	SAVE TR ON TAPE	X	6-10-01
11	SAVE LOGIC TREE	X	6-11-01
12	LIST TREES	X	2-04-01
13	SELECT DATA SET	X	8-13-01
14	DRAW TREE	X	2-05-01
15	RET TO INIT FRM	X	2-1

WPS FRAME

FRAME NAME: FUNCT

CALLING SEQUENCE 08

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	SINGLE WAVE/EDIT	X	8-1
01	MULTI WAVE INIT	X	12-1
02	WAV TO WAV TRANS	X	14-1
03	SEGMENTATION	X	18-1
04	(blank)		
05	"		
06	PARLAN	X	19-1
07	(blank)		
08	"		
09	LIST TREES	X	2-04-01
10	SELECT DATA SET	X	8-13-01
11	DRAW TREE	X	2-05-01
12	(blank)		
13	"		
14	RET TO INIT FRM	X	2-1
15	HARDCOPY	X	

SINGLE DISPLAY FRAME

FRAME NAME: SINGLE

CALLING SEQUENCE 08-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	DISPLAY NEXT	X	8-00-01
01	DISPLAY SAME	X	8-01-01
02	DISPLAY NAMED	X	8-02-01
03	DISPLAY PREVIOUS	X	8-03-01
04	HORIZONTAL SCALE	X	8-04-01
05	VERTICAL SCALE	X	8-05-01
06	CONTINUE WAVE	X	8-06-01
07	SCROLL	X	8-07-01
08	SELECT SEQUENCE	X	8-08-01
09	ZOOM	X	
10	SEL START TIME	X	8-10-01
11	XTENDED OPTIONS	X	9-1
12	EDIT	X	10-1
13	SELECT DATA SET	X	8-13-01
14	RET TO WPS FRAME	X	7-1
15	HARDCOPY	X	

EXTENDED OPTIONS FRAME

FRAME NAME: EXTOPN

CALLING SEQUENCE 08-00-11

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	LIST COORDS		
01	(blank)		
02	DISP CALC MARKS		
03	DISP APR MARKERS		
04	(blank)		
05	"		
06	"		
07	"		
08	WAVE PLAYBACK	X	10-1
09	(blank)		
10	DISPLAY NEXT	X	8-00-01
11	DISPLAY SAME	X	8-01-01
12	CONTINUE WAVE	X	8-06-01
13	RET TO SINGLE WAVE	X	8-1
14	RETURN TO WPS	X	7-1
15	HARDCOPY	X	

PLAYBACK FRAME

FRAME NAME: PLAYBK

CALLING SEQUENCE 08-00-11-09

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	PLAY THIS PART		10-00-01
01	PLAY THIS WAVE		10-01-01
02	PLAY A NEW WAVE		10-02-01
03	LIGHT PEN PLAY		10-02-01
04	(blank)		
05	"		
06	"		
07	"		
08	DISPLAY SAME	X	8-01-01
09	DISPLAY NEXT	X	8-00-01
10	DISPLAY PREVIOUS	X	8-03-01
11	DISPLAY NAMED	X	8-02-01
12	RET TO EXT OPT	X	9-1
13	RET TO SINGLE	X	8-1
14	RET TO WPS FRAME	X	7-1
15	HARDCOPY	X	

EDIT FRAME

FRAME NAME: WVFEDT

CALLING SEQUENCE 08-00-01

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	CHANGE ID	X	11-00-01
01	MODIFY TEXT		11-01-01
02	TRUNCATE BACK	X	11-02-01
03	TRUNCATE FRONT	X	11-03-01
04	INSRT APR SEG MK	X	11-04-01
05	SPCFY TEMP SYMB	X	11-05-01
06	SEGMENT WAVEFORM	X	11-06-01
07	DELETE WAVEFORM	X	11-07-01
08	MODIFY TIME REF	X	
09	SELECT DATA SET	X	11-09-01
10	CONTINUE WAVE	X	8-06-01
11	DISPLAY SAME	X	8-01-01
12	DISPLAY NEXT	X	8-00-01
13	RET TO SIN FRAME	X	8-1
14	RET TO WPS FRAME	X	7-1
15	HARDCOPY	X	

MULTIPLE WAVE INITIAL FRAME

FRAME NAME: MINIT

CALLING SEQUENCE 08-01-

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	SELECT DATA SETS	X	12-00-01
01	MULTI PAGE INIT	X	12-01-01
02	MULTI SCROLL INIT	X	12-02-01
03	(blank)		
04	"		
05	"		
06	"		
07	"		
08	"		
09	"		
10	"		
11	"		
12	LIST TREES	X	2-04-01
13	DRAW TREE	X	2-05-01
14	RET TO WPS FRME	X	7-1
15	RET TO INIT FRAME	X	2-1

MULTIPLE WAVE DISPLAY FRAME

FRAME NAME: MWVDSP

CALLING SEQUENCE 08-1-14

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	DISPLAY NEXT	X	13-00-01
01	DISPLAY NEXT (PICK)	X	13-01-01
02	CONTINUE WAVE	X	13-02-01
03	CONTINUE (PICK)	X	13-03-01
04	DISPLAY SAME	X	13-04-01
05	SCROLL	X	13-05-01
06	VERTICAL SCALING	X	13-06-01
07	HORZ SCALING	X	13-07-01
08	SEQUENCE SELECTN	X	13-08-01
09	SELECT START VAL	X	13-09-01
10	(blank)		
11	TRNSLATION	X	13-11-01
12	(blank)		
13	RET TO M-W INIT	X	12-1
14	RET TO WPS FRAME	X	7-1
15	HARDCOPY	X	

WAVE TO WAVE TRANSFORMATION FRAME

FRAME NAME: WAVE

CALLING SEQUENCE 08-02

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	SPCTRAL ANALYSIS	X	15-1
01	ALGEB/CALCULUS	X	16-1
02	ARITHMETIC	X	17-1
03	(blank)		
04	"		
05	"		
06	"		
07	"		
08	"		
09	"		
10	LIST TREES	X	4-00-01
11	SELECT DATA SET	X	8-13-01
12	DRAW TREES	X	2-05-01
13	RET TO WPS FRAME	X	7-1
14	RETURN INIT FRME	X	2-1
15	HARDCOPY	X	

SPECTRAL ANALYSIS FRAME

FRAME NAME: SPCTRM

CALLING SEQUENCE 08-02-01

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	INPUT DATA SET	X	15-00-01
01	OUTPUTS	X	15-01-01
02	WAVE SEQUENCE #	X	15-02-01
03	POINT SEQUENCE #	X	15-03-01
04	WINDOW OPTION	X	15-04-01
05	WEIGHTING	X	15-05-01
06	WINDOW FILL	X	15-06-01
07	CHANGE SPC PARAMS	X	15-07-01
08	EXECUTE	X	15-08-01
09	(blank)		
10	LIST TREES	X	4-00-01
11	WAVE/WAVE TRANS	X	14-1
12	SINGLE WAVE/EDIT	X	8-1
13	MULTIPLE WAVE	X	12-1
14	RET TO WPS FRAME	X	7-1
15	HARDCOPY	X	

ALGEBRAIC/CALCULUS FRAME

FRAME NAME: ALGCAL

CALLING SEQUENCE 08-02-02

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	NORMALIZE		
01	SMOOTHING		
02	ARITHMETIC		
03	DEMODULATION		
04	RECTIFICATION	X	16-04-01
05	INDEF INTEGRAL		
06	DIFFERENCE		
07	EXPONENTIAL		
08	LOG		
09	FREQ TRANS		16-09-01
10	LIST TREES	X	2-04-01
11	SELECT DATA SET	X	8-13-01
12	DRAW TREE	X	2-05-01
13	RET TO SINGLE ANG	X	14-1
14	RET TO W/W TRNSF	X	7-1
15	RET TO WPS FRAME	X	

ARITHMETIC FRAME

FRAME NAME: ARITHC

CALLING SEQUENCE 08-02-02-02

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	ADD/SUB		
01	MULT/DIV		
02	$Y = AX+B$		
03	$Y = A(X-AVE)$		
04	Every PTH, PT		
05	SHIFT		
06	LATERIAL GRIDS		
07	DC-REMOVAL		
08	(blank)		
09	"		
10	SPEC, PROTOTYPE		
11	LIST TREES	X	2-04-01
12	DRAW TREES	X	2-05-01
13	SEL DATA SET	X	8-13-01
14	RET TO AL/CAL	X	16-1
15	RET TO W/W TRANS	X	14-1

SEGMENTATION FRAME

FRAME NAME: SEGMENT

CALLING SEQUENCE 08-03

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	BEGIN MARK	X	18-00-01
01	END MARK	X	18-01-01
02	THRES OPT BEGIN	X	18-02-01
03	THRES OPT END	X	18-03-01
04	CREATE MARKERS	X	18-04-01
05	SEGMENT ASSIGNED	X	18-05-01
06	SEGMENT APRIORI	X	18-06-01
07	CREATE PROTOTYPE	X	18-07-01
08	SINGLE	X	8-1
09	RET TO EDIT	X	8-1
10	LIST TREES	X	2-04-01
11	SELECT DATA SET	X	8-13-01
12	DRAW TREE	X	2-05-01
13	***		11-1
14	RET TO WPS FRAME	X	7-1
15	RET TO INIT FRAME	X	2-1

PARLAN FRAME

FRAME NAME: PARLAN

CALLING SEQUENCE 08-06-

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	CARD INPUT	X	19-00-01
01	(blank)		
02	EDIT PROGRAM	X	19-02-01
03	COMPILE PROGRAM	X	19-03-01
04	EXECUTE PROGRAM	X	19-04-01
05	DELETE PROGRAM	X	19-05-01
06	PRINT PROGRAM	X	19-06-01
07	(blank)		
08	"		
09	"		
10	LIST DIRECTORY	X	4-00-01
11	LIST TREES	X	2-04-01
12	DRAWTREE	X	2-05-01
13	RET TO WPS FRM	X	7-1
14	RET TO INIT FRM	X	2-1
15	HARDCOPY	X	

INITIAL FRAME FOR OLPARS

FRAME NAME: OLFFRM

CALLING SEQUENCE: 09

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	STRUCT ANALY	X	21-1
01	MEASURE EVAL	X	25-1
02	TRANSFORMS	X	29-1
03	DF LOGIC DESIGN	X	30-1
04	EDIT NAME & SAVE	X	38-1
05	Blank		
06	"		
07	"		
08	"		
09	"		
10	"		
11	SELECT DATA SET	X	8-13-1
12	LIST TREES	X	2-04-1
13	DRAW TREE	X	2-05-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

STRUCTURE ANALYSIS FRAME

FRAME NAME: STRANL

CALLING SEQUENCE: 09-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	EIGENVECTORS	X	21-00-01
01	COORD VECTORS	X	21-01-01
02	GEN DISCRIM VECS		21-02-01
03	ARBITRARY VECS	X	21-03-01
04	FISHER VECTORS	X	21-04-01
05	Blank		
06	"		
07	"		
08	"		
09	"		
10	SELECT DATA SET	X	8-13-01
11	LIST TREES	X	2-04-01
12	DRAW TREE	X	2-05-01
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

ONE-SPACE PLOT FRAME

FRAME NAME: 1SPACE

CALLING SEQUENCE: 09-00-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	SELECT CLASSES	X	22-00-01
01	CHNGE BIN PARAMS	X	22-01-01
02	CHNGE PAGE SIZE	X	22-02-01
03	DISP BIN COUNT	X	22-03-01
04	ZOOM OPTIONS	X	24-1
05	COMPARE CLASSES	X	22-05-01
06	LOCAL VERT SCL	X	22-06-01
07	GLOBAL VERT SCL	X	22-07-01
08	NEXT CLASS	X	22-08-01
09	NEXT PAGE	X	22-09-01
10	NAME & SAVE	X	22-10-01
11	SET THRESHOLDS	X	22-11-01
12	PARTITION	X	
13	SELECT BASIS	X	
14	RET STRUCT ANAL	X	21-1
15	HARDCOPY		

TWO-SPACE PLOT FRAME

FRAME NAME: 2SPACE

CALLING SEQUENCE: 09-00-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	NEXT PAGE	X	23-00-01
01	CHANGE SCALE	X	23-01-01
02	PRINT IDS	X	23-02-01
03	BLINK	X	23-03-01
04	ELIMINATE	X	23-04-01
05	NAME SAVE	X	23-05-01
06	CLUSTER		23-06-01
07	ZOOM	X	24-1
08	DRAW BOUNDARY	X	23-08-01
09	PARTITION	X	
10	Blank		
11	"		
12	RET STRUCT ANAL	X	21-1
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

ZOOM OPTIONS

FRAME NAME: ZMOPTS

CALLING SEQUENCE: 09-00-00-04

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	FULL RANGE	X	24-00-01
01	DIAL RANGE	X	24-01-01
02	TYPE RANGE	X	24-02-01
03	TYPE BIN RANGE	X	24-03-01
04	Blank		
05	"		
06	"		
07	"		
08	"		
09	"		
10	"		
11	"		
12	"		
13	"		
14	"		
15	"		

MEASUREMENT EVALUATION FRAME

FRAME NAME: MEAEVL

CALLING SEQUENCE: 09-01

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	DISCRIM MEASURE	X	25-00-01
01	PROB OF CONFUS	X	25-01-01
02	Blank		
03	"		
04	"		
05	"		
06	"		
07	"		
08	"		
09	"		
10	SELECT DATA SET	X	8-13-01
11	LIST TREES	X	2-04-01
12	DRAW TREE	X	2-05-01
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

DISCRIMINANT MEASURE EVALUATION FRAME

FRAME NAME: DMFRM

CALLING SEQUENCE: 09-01-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	RANK OVERALL	X	26-00-01
01	SEL CLASS/RANK	X	26-01-01
02	SEL PAIR/RANK	X	26-02-01
03	SEL MEA/RANK CLS	X	26-03-01
04	SEL MEA/RANK PR	X	26-04-01
05	UNION BEST CLASS	X	26-05-01
06	UNION BEST PAIR	X	26-06-01
07	SELECT CUTOFF	X	26-07-01
08	SELECT ANY MEA	X	26-08-01
09	CREATE TREE	X	26-09-01
10	PRINT DISPLY	X	26-10-01
11	Blank		
12	RET MEA EVAL	X	25-1
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

PROBABILITY OF CONFUSION INITIALIZATION FRAME

FRAME NAME: PCIFRM

CALLING SEQUENCE: 09-01-01

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	CHANGE RANGE	X	27-00-01
01	CHANGE BIN SIZE		
02	CHANGE NUM BINS	X	27-01-01
03	DISPLAY RANGES	X	27-02-01
04	NEXT PAGE	X	27-03-01
05	CONTINUE	X	27-04-01
06	Blank		
07	"		
08	"		
09	"		
10	"		
11	"		
12	RET NEA EVAL	X	25-1
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

PROBABILITY OF CONFUSION EVALUATION FRAME

FRAME NAME: PCFRM

CALLING SEQUENCE: 09-01-01-05

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	RANK OVERALL	X	28-00-01
01	SEL CLASS/RANK	X	28-01-01
02	SEL PAIR/RANK	X	28-02-01
03	SEL MEA/RANK	X	28-03-01
04	SEL MEA/RANK PR	X	28-04-01
05	UNION BEST CLASS	X	28-05-01
06	UNION BEST PAIR	X	28-06-01
07	SELECT CUTOFF	X	28-07-01
08	SELECT ANY MEA	X	28-08-01
09	CREATE TREE	X	28-09-01
10	PRINT DISPLAY	X	28-10-01
11	RET PROB CONF	X	28-11-01
12	RET MEA EVAL	X	27-1
13	RET OLPARS FRM	X	25-1
14	RET INIT FRAME	X	20-1
15	HARDCOPY	X	

TRANSFORMATIONS FRAME

FRAME NAME: TRNFRM

CALLING SEQUENCE: 09-02

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	EIGENVECTORS		
01	NORMALIZATION		
02	MEA REDUCTION		
03	Blank		
04	"		
05	"		
06	"		
07	"		
08	"		
09	"		
10	SELECT DATA SET	X	8-13-01
11	LIST TREES	X	2-04-01
12	DRAW TREE	X	2-05-01
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY		

DISTRIBUTION FREE LOGIC DESIGN FRAME

FRAME NAME: LOGDES

CALLING SEQUENCE: 09-03

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	CREATE LOGIC	X	30-00-01
01	EVALUATE LOGIC	X	30-01-01
02	PAIRWISE MOD	X	30-02-01
03	CREATE BOOL REJ	X	30-03-01
04	CHG APRIORI PROB	X	30-04-01
05	DRAW LOG TREE	X	30-05-01
06	DELETE LOG TREE	X	30-06-01
07	DELETE LOG NODE	X	30-07-01
08	LIST LOG TREES	X	30-08-01
09	SELECT LOG TREE	X	30-09-01
10	PRINT LOG TREE	X	30-10-01
11	SELECT DATA SET	X	8-13-01
12	LIST TREES	X	2-04-01
13	DRAW TREE	X	2-05-01
14	RET OLPARS FRM	X	2-1
15	HARDCOPY	X	

CREATE LOGIC FRAME

FRAME NAME: CRELOG

CALLING SEQUENCE: 09-03-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	EIGENVECTORS	X	31-00-01
01	COORD VECTORS	X	31-01-01
02	GEN DISCRIM VECs	X	
03	ARBITRARY VECs	X	31-03-01
04	FISHER PAIRWISE	X	31-04-01
05	NEAREST MEAN	X	31-05-01
06	BOOLEAN	X	31-06-01
07	DRAW LOG TREE	X	31-07-01
08	Blank		
09	"		
10	"		
11	"		
12	RET DF FRM	X	30-1
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

HISTOGRAM PLOT FRAME (DIST:FREE)

FRAME NAME: DFHIST

CALLING SEQUENCE: 09-03-00-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	SELECT CLASSES	X	32-00-01
01	CHNGE BIN PARAMS	X	32-01-01
02	CHNGE PAGE SIZE	X	32-02-01
03	DISP BIN COUNT	X	32-03-01
04	ZOOM OPTIONS	X	24-1
05	COMPARE CLASSES	X	32-05-01
06	LOCAL VERT SCL	X	32-06-01
07	GLOBAL VERT SCL	X	32-07-01
08	NEXT CLASS	X	32-08-01
09	NEXT PAGE	X	32-09-01
10	SET THRESHOLDS	X	32-10-01
11	EVALUATE	X	32-11-01
12	SELECT BASIS	X	32-12-01
13	RET CRELOG FRM	X	31-1
14	RET DF FRM	X	30-1
15	HARDCOPY	X	

SCATTER PLOT FRAME

FRAME NAME: DFSCAT

CALLING SEQUENCE: 09-03-00-00

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	NEXT PAGE	X	33-00-01
01	CHANGE SCALE	X	33-01-01
02	PRINT IDS	X	33-02-01
03	BLINK	X	33-03-01
04	ELIMINATE	X	33-04-01
05	CLUSTER		33-05-01
06	ZOOM	X	24-1
07	DRAW BOUNDARY	X	33-07-01
08	EVALUATE	X	33-08-01
09	SELECT BASIS	X	33-09-01
10	Blank		
11	RET CRELOG FRM	X	31-1
12	RET DF FRM	X	30-1
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

LOGIC EVALUATION FRAME

FRAME NAME: LOGEVL

CALLING SEQUENCE: 09-03-01

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	OVERALL EVAL	X	34-00-01
01	CHANGE SYMBOLS	X	34-01-01
02	Blank		
03	"		
04	"		
05	"		
06	"		
07	"		
08	"		
09	"		
10	"		
11	"		
12	RET DF FRM	X	30-1
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

PAIRWISE MODIFICATION FRAME

FRAME NAME: PWMOD

CALLING SEQUENCE: 09-03-02

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	ARBITRARY VECS	X	35-00-01
01	HISTOGRAM	X	35-01-01
02	DISCRIM PLANE	X	35-02-01
03	BOOLEAN	X	35-03-01
04	CHANGE # THRESH MOTH	X	35-04-01
05	EVALUATE	X	35-05-01
06	Blank		
07	"		
08	"		
09	"		
10	"		
11	"		
12	"		
13	"		
14	"		
15	HARDCOPY	X	

HISTOGRAM FOR FISHER PAIRWISE MODIFICATION FRAME

FRAME NAME: DFHFH

CALLING SEQUENCE: 09-03-02-01

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	CHNGE BIN PARAMS	X	36-00-01
01	ZOOM OPTIONS	X	24-1
02	COMPARE CLASSES	X	36-02-01
03	LOCAL VERT SCL	X	36-03-01
04	GLOBAL VERT SCL	X	36-04-01
05	DISP BIN COUNT	X	36-05-01
06	MOVE THRESHOLDS	X	36-06-01
07	RE-SELECT PAIR	X	36-07-01
08	EVALUATE	X	36-08-01
09	Blank		
10	"		
11	"		
12	"		
13	"		
14	RET PWISE FRM	X	35-1
15	HARDCOPY	X	

SCATTER PLOT FOR DISCRIM PLANE FOR PAIRWISE MODIFICATION

FRAME NAME: DFSDSP

CALLING SEQUENCE: 09-03-02-02

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	NEXT PAGE	X	37-00-01
01	CHANGE SCALE	X	37-01-01
02	PRINT IDS	X	37-02-01
03	BLINK	X	37-03-01
04	ELIMINATE	X	37-04-01
05	CLUSTER		37-05-01
06	ZOOM	X	24-1
07	DRAW BOUNDARY	X	37-07-01
08	RE-SELECT PAIR	X	37-08-01
09	EVALUATE	X	37-09-01
10	Blank		
11	"		
12	"		
13	"		
14	RET PWISE FRM	X	35-1
15	HARDCOPY	X	

EDIT NAME AND SAVE FRAME

FRAME NAME: NASFRM

CALLING SEQUENCE: 09-04

<u>OPT #</u>	<u>OPTION NAME</u>	<u>STATUS</u>	<u>PAGE</u>
00	DISPLAY ENTRIES	X	38-00-01
01	INITIALIZE N&S	X	38-01-01
02	DELETE VECTOR	X	38-02-01
03	PRINT VECTOR	X	38-03-01
04	KEYBD INPUT	X	38-04-01
05	CARD INPUT	X	
06	Blank		
07	"		
08	"		
09	"		
10	"		
11	"		
12	"		
13	RET OLPARS FRM	X	20-1
14	RET INIT FRAME	X	2-1
15	HARDCOPY	X	

SECTION 2

INITIAL FRAME

Frame Name: FRAME 1

Call Sequence: NONE (Appears as soon as WPS is on the air)

FRAME 1

INITIAL FRAME

GENERAL DESCRIPTION:

Frame 1 is the initial frame presented to the user once WPS is run. If the collection of frames constituting the system is viewed as a tree structure then FRAME 1 must be considered the root frame. This then is an offering of the two sub-systems, WPS and OLPARS, frames common to these systems, and finally data and data structure inquiry options also common to the sub-systems (list directory, list trees, and draw tree).

MENU

DESCRIPTION ON PAGE

00 - INITIALIZE	[Not Implemented]
01 - INPUT DATA	3-1
02 - TREE MANIPULATIONS	4-1
03 - LIST DIRECTORY	4-00-01
04 - LIST TREES	2-04-01
05 - DRAW TREE	2-05-01
06 - STATISTICAL TABULATIONS	5-1
07 - OUTPUT DATA	6-1
08 - WPS	7-1
09 - OLPARS	20-1
10 - PARLAN	19-1
11 - PROGRAM TEST X	} For Program Development and Test. Not for user.
12 - PROGRAM TEST Y	
13 - PROGRAM TEST Z	
14 - FRAME "Q"	} Not Described
15 - HARDCOPY	

FRAME 1

OPTION

04 - LIST TREES

GENERAL DESCRIPTION:

All trees (all data types) and their associated text annotations are listed on the system display screen.

DIALOGUE:

S1 System:

Lists as many trees on one page as possible. If more than one page is required then the following ensues, otherwise end transactions. < "Y" TO COPY PAGE >

User:

A entry of "Y" or "y" will hardcopy the page. Anything else will not produce a copy.

System:

Gets the next page of trees and reverts to S1 until listing of all system trees is complete.

ERROR MESSAGES:

< DISK READ FAULT >

Attempt to read some portion of the directory failed - hardware fault.

FRAME 1

OPTION

05 - DRAW TREE

GENERAL DESCRIPTION:

A tree on the system is identified by the user and the tree structure is shown on the display screen along with its test log.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

Enters a number corresponding to the desired tree's data type.

System:

< ENTER 6 CHARACTER TREE NAME >

User:

Enters 6 characters or less to identify the tree.

System:

Draws tree showing all nodes, number of waveform or vectors for each low node, and total number of waveforms or vectors for tree.

ERROR MESSAGES:

< DISK READ FAULT >

Attempt to read either a portion of the data directory or the tree table sectors failed - hardware fault.

< NON-EXISTENT TREE >

Tree specified could not be found in the data directory. (Check tree name spelling.)

2-05-01

SECTION 3

INPUT DATA FRAME

Frame Name: INPDTA

Call Sequence: 01

INPDTA

01

INPUT DATA FRAME

GENERAL DESCRIPTION:

This frame allows all system data inputs. Waveform data may be input by tape or cards. The use of cards is mainly for prototype introduction but can serve as a tree input as well. Vector and logic tree data may be entered via tape. Data and data structure inquiry options are also included. Furthermore, tree text may be modified in this frame.

<u>MENU</u>	<u>DESCRIPTION ON PAGE</u>
00 - INPUT WAVE DATA	3-00-01
01 - VECTOR TAPE INPUT	3-01-01
02 - WAVE CARD INPUT	3-02-01
03 - VECTOR CARD INPUT	[Not Implemented]
04 - RESTORE WAVE TREE	3-04-01
05 - RESTORE VECTOR TREE	3-05-01
06 - NAME AND SAVE	[Not Implemented]
07 - MODIFY TREE TEXT	[Not Implemented]
08 - INPUT LOGIC TREE	3-08-01
09 - ***	
10 - ***	
11 - LIST DIRECTORY	4-00-01
12 - LIST TREES	2-04-01
13 - DRAW TREE	2-05-01
14 - RETURN TO INIT FRAME	2-1
15 - HARDCOPY	

INPDTA

01

OPTION

00 - INPUT WAVE DATA

GENERAL DESCRIPTION:

This option allows the user to input waveform data from magnetic tape to the system disk. The tape must be in "WPS" format and mounted on unit one. (See Appendix B for Tape Format).

DIALOGUE:

System:

<Y = YES TO SWAP BYTES>

User:

"Y" "CR" => Data words will be byte swapped

"CR" => Normal input

System:

<ENTER 6 CHARACTER TREE NAME>

User:

Enter from one to six characters and "CR".

The input data tree will be assigned this acronym.

System:

<ENTER 5 CHARACTER NODE NAME >

User:

Enter from one to five characters. This query will be repeated for each node in the tree.

System:

<TRANSFER IN PROGRESS >

ERROR MESSAGES:

< FILING ERROR >

Fatal error in attempting to create tree file. Check for duplicate file names.

< TAPE ENDED-MOUNT NEW TAPE AND PRESS CR TO CONTINUE >

End of tape marker encountered.

INPDTA

01

OPTION

01 - VEC TAPE INPUT

GENERAL DESCRIPTION:

This option permits the user to input into the system any number of OLPARS data trees from tape. (See Appendix D for tape format, place on unit 1).

DIALOGUE:

System:

< TAPE FORMAT, F-FLOATING I-INTEGERS >

User:

"F" "CR" for vectors stored on tape as 11/45 floating point numbers.

"I" "CR" for vectors stored in 16 bit integer numbers.

System:

< NUMBER OF TREES TO BE SKIPPED >

User:

If there is more than one tree stored on tape a user can go to a specific tree and input. If the first tree on tape is to be read in, type "0" "CR"; otherwise integer "CR".

S1: System:

< DIMENSIONALITY >

User:

Type in dimensionality of data tree. (Integer "CR").

System:

< 6 CHARACTER TREE NAME >

User:

Type in 6 character "CR" to define tree in system.

System:

SHIFT DECIMAL POINT N PLACES

User:

Type in an integer "CR" for the decimal shift. An example is "2" "CR". This causes each element in the vector to be multiplied by 10^{**2} . Type in "0" "CR" if no decimal shift.

S2: SYSTEM:

5 CHARACTER NODE NAME, . TO TERMINATE TREE

User:

"." "CR" terminate input to this tree. If there are more trees on the tape, go to S2; else go to S4.

"CR" takes node name from tape.

5 Characters "CR" create a data class having this name.

Note: Be sure last character is unique to the tree and not a blank.

System:

Draw input tree

TAPE INPUT IN PROGRESS

Go to S2 if there are more classes associated with the input tree. If there is another tree on tape, go to S5; else exit.

S4: System:

FORWARDING TAPE

If there is another tree on tape, go to S5; else exit.

S5: System:

CR TO CONTINUE TAPE INPUT

This indicates there is another tree on tape. "CR" to continue reading. Go to S1. Anything else, "CR" to exit.

ERROR MESSAGE:

NAME ERROR, TYPE NEW NAME

Tree name already exists in system; type in a different tree name.

ERROR

System I/O error, check hardware.

OPTION:

02 - WAVE CARD INPUT

GENERAL DESCRIPTION:

Waveform data may be introduced to the system via cards. The main purpose is the creation of a prototype waveform for some experimental waveform manipulations, but an entire data set may also be constructed.

The format for the cards is as follows:

CARD/CC1 CC80/

1 : Type/sampling rate

o Type is either

(a) "TEMPORAL" for time domain

(b) "SPECTRAL" for frequency domain

o Sampling rate is an integer value less than 65535

2 : F1&F2&F3&F4&.....&Fn

Fn is a single precision floating point number any format. A data card need not be completely filled.

3 : Same as 2

.
.
.

M : Same as 2 (last data points for this wave)

* (column 1)

* indicates end of waveform. Additional waveforms follow same format from card 2. End of file is denoted by \$ in the first column. Four thousand points per waveform is the limiting value.

DIALOGUE

System:

< ENTER TREE NAME >

User:

6 characters or less may be entered

System:

< ENTER NODE NAME >

User:

5 characters or less may be entered.

System:

Reads first card

< ENTER TREE TEXT >

User:

60 characters or less of descriptive tree text are entered.

System:

Reads remaining cards

ERROR MESSAGES:

< PROGRAM ERROR > - fatal

Programming logic failed or node name given already exists under the specified tree. Check directory for duplicate; otherwise call maintenance.

< ILLEGAL FORMAT > - fatal

Card format is wrong; correct and try again.

INPDTA

01

OPTION

04 - RESTORE WAVE TREE

GENERAL DESCRIPTION:

This routine transfers from magnetic tape to disk, the tree which is stored on tape in "TXTAPE" format. (The format is given in the WPS Software Documentation.)

NOTE: As a prerequisite to running the routine the user must mount the tape on unit 1, have it on-line, and at load point.

DIALOGUE:

< TRANSFER IN PROGRESS >

< TRANSFER COMPLETE >

ERROR MESSAGES:

< EOF DETECTED >

Operation aborted due to premature end of file on tape
- check tape format.

< I/O OR FILING SYSTEM ERROR >

System error. Check for a duplicate file name on disk.

< RP02LK ERROR >

There is not enough room on disk.

FRAME: INPDTA

01

OPTION:

08 - INPUT LOGIC TREE

GENERAL DESCRIPTION:

This option transfers logic trees (Data types 20, 21, and 22), requested by the user, from 9-track magnetic tape to the system disk. All logic tree names on the system disk are displayed on the Vector General before and after the transfer. The system informs the user of the number of requested logic trees which were not able to be transferred because they did not exist on the mag tape or due to a system exit caused by a hardware error. The mag tape driver must be on line and on unit select 0 (zero) before execution of this program. (The format for storing logic trees on magtape is given in the Software Documentation.)

DIALOGUE:

System:

LOGIC TREE NAME CR TO EXIT

User:

The user will respond with one of the following options:

(a) Name CR

(b) CR

where NAME is a 6 character logic tree name. The first option causes the system to store in input logic tree name, NAME, and then return to ask the user for another logic tree name. The second option will cause the system to start transferring the input logic trees from the mag tape to the system disk unless no logic tree names were input. In this case the system will exit.

ERROR MESSAGES:

< "N" OF TREES REQUESTED WERE NOT ON TAPE >

"N" represents the number of trees which did not transfer to completion. Cause of failure is hardware fault; disk write or magtape read.

< AN ERROR HAS OCCURRED >

I/O error returns from "PUT" or "CLOSE"; either a hardware or program fault.

SECTION 4

TREE MANIPULATIONS FRAME

Frame Name: SYSUT

Call Sequence: 02

SYSUT

02

TREE MANIPULATIONS FRAME

GENERAL DESCRIPTION:

This frame contains options to display tree structures or text and to re-structure and create trees.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - LIST DIRECTORY	4-00-01
01 - LIST TREES	2-00-01
02 - DRAW TREE	2-05-01
03 - DELETE TREE	4-03-01
04 - DELETE NODE	4-04-01
05 - DEL SUBSTRUCTURE	4-05-01
06 - (blank)	
07 - COMBINE NODES	4-07-01
08 - CREATE TREE	4-08-01
09 - (blank)	
10 - "	
11 - "	
12 - "	
13 - SELECT DATA SET	8-13-01
14 - RET TO INIT FRAME	2-1
15 - HARDCOPY	

OPTIONS

00 - LIST DIRECTORY

GENERAL DESCRIPTION:

All files existing in the system's data directory are listed on the system display screen. Any extensions of a file from the directory to the system's sector table are listed to the right.

DIALOGUE:

S1 System:

Lists as many directory entries as possible on one page.

If more than one page is required then the following ensues,
otherwise end transactions <"Y" TO COPY PAGE >

User:

An entry of "Y" or "y" will hardcopy the page - anything else
will not produce a copy.

System:

Displays the next page of directory entries and reverts to S1
until listing of all directory entries is complete.

ERROR MESSAGES:

<DISK READ FAULT >

Attempt to read some portion of the directory failed - hardware fault.

OPTIONS

03 - DELETE TREE

GENERAL DESCRIPTION:

In this option a user may delete a tree (either of waveforms or vectors) from the directory. Any text file associated with the tree is automatically deleted also.

NOTE: The capability of deleting associated mean-covariance files from the directory in this option does not exist at present but will be implemented in the near future.

DIALOGUE:

System:

< ENTER TREE NAME >

User:

The name is up to six characters long.

System:

< ENTER DATA TYPE >

User:

Enters 13 or 63.

ERROR MESSAGE:

< NON-EXISTENT FILE OR DISK ERROR >

This message appears if any node (including the tree name or senior node) happens to exist in the tree table but not in the directory. This happens if, as a file, the node had been deleted from the directory.

SYSUT

OPTIONS

04 - DELETE NODE

GENERAL DESCRIPTION:

This option allows the deletion of a node and its sub-structure from a tree. For vector data, the associated mean-covariance file is deleted also.

NOTE: Other mean-covariance files are not updated by this option, and mean-covariance files associated with nodes which had existed beneath the deleted node are not deleted from the directory.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

Enters 63 or 13

System:

< ENTER TREE NAME >

User:

Enters a name up to six characters

System:

< ENTER 5 CHARACTER NODE NAME >

The name entered may be from one to five characters.

ERROR MESSAGE:

< ERROR >

The node did not exist either in the tree table or directory table or both.

4-04-01

SYSUT

02

OPTION

05 - DELETE SUBSTRUCTURE

GENERAL DESCRIPTION:

This routine will delete the entire tree structure under a designated node, and combine all data into one low node located under the designated node's immediate senior node. The low node name is user-supplied, and must be unique.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

Enter 63 if waveforms, 13 if vectors and CR.

System:

< ENTER TREE NAME >

User:

Enter name of tree to be operated on and CR. Tree name cannot exceed six characters.

System:

< ENTER 6 CHARACTER DESIGNATED NODE NAME >

User:

Enter name of immediate senior node, under which all data will be combined. The node name must be preceded by the tree symbol.

System:

< ENTER 5 CHAR. NEW LOW NODE NAME >

User:

Enter any name up to 5 characters and CR.

ERROR MESSAGES:

< FILING SYSTEM ERROR >

System retrieval error - operation aborted.

< RP02 READ ERROR >

< RP02 WRITE ERROR >

OPTIONS

07 - COMBINE NODES

GENERAL DESCRIPTION:

This option allows a user to combine two or more nodes into a single node. The nodes to be combined must all exist on the same level and share a common immediate senior node. The nodes that were combined are deleted and the new combined node exists in their place. In the case of vector data, a new mean-covariance file is created from the new combined node.

When all the nodes on one level are combined, their new name replaces the name of their immediate senior node, except if the immediate senior node is the senior node of the tree.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

63=waveform, 13=vector

System:

< ENTER TREE NAME >

User:

Enters a name up to six characters of the tree containing the nodes to be combined.

System:

< ENTER NODE NAMES TO BE COMBINED, SEPARATING
EACH BY A COMMA OR A > . >

User:

Up to a maximum of 24 node names may be entered. Each node name may be from one to five characters long.

System:

< ENTER NEW NODE NAME >

User:

Enters a name up to five-characters of the new node that will exist in the data tree.

ERROR MESSAGES:

< INPUT FILE ERROR ON _ _ _ _ _ >

The blanks are filled in with a node name which could not be found in the directory.

< ERROR - ALL NODES NOT UNDER SAME IMMEDIATE SENIOR NODE >

The nodes must be on the same level as well.

< FILE SYSTEM ERROR >

< OUTPUT FILE ERROR >

OPTIONS

08 - CREATE TREE

GENERAL DESCRIPTION:

This option allows a user to create a tree from a set of lowest or senior nodes from as many trees as the names of which may be entered on one VG line. The created tree may have only one level of lowest nodes.

The input trees should all be associated with the same type of data - either waveforms or vectors. If, when associated with waveform data, the sampling rates are not the same, the user may continue or discontinue the program. In the former case the sampling rate is taken from the first tree name input.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

Enters 63 for waveform data, 13 for vector data. This data type will be the data type of the new tree to be created and also the data type of all the input trees.

System:

< ENTER NEW TREE NAME >

User:

Enters a name up to six characters of the tree to be created.

System:

< ENTER NEW NODE NAMES. SEPARATE EACH BY COMMA OR "<". >

User:

The node names entered may be one to five characters long.

System:

<ENTER INPUT TREE NAMES. SEPARATE EACH BY COMMA OR > . >

User:

The tree names entered may be one to six characters long.

For each new node name entered, the system responds with the following message repeatedly until all input trees are mentioned:

< ENTERED NODE NAMES FROM TREE _ _ _ _ _

TO MAKE NEW NODE _ _ _ _ _

SEPARATE EACH BY COMMA OR > . >

User:

The user may choose input nodes from the input tree which is displayed on the VG. Each input tree will be displayed along with the message.

ERROR MESSAGES:

The following error messages terminate the option:

< FILE SYSTEM ERROR >

The tree name entered is illegal because the first character is the same as that of an already existing tree.

< NEW NODE NAME ERROR >

< INPUT TREE NODE ERROR >

< RP02 ERROR >

The following message waits for the user's reply:

<SAMPLING RATES FOR INPUT TREES ARE DIFFERENT. HIT "D" TO
DISCONTINUE PROGRAM >

User:

Enters "D" and no tree is created. If "D" is not entered,
then the new tree will have the sampling rate of the first
input tree.

For vectors, the following message terminates the option:

< DIMENSIONALITIES FOR INPUT TREES ARE DIFFERENT.

PROGRAM DISCONTINUED >

SECTION 5

STATISTICAL TABULATION FRAME

Frame Name: STATAB

Call Sequence: 06

STATISTICAL TABULATION FRAME

GENERAL DESCRIPTION:

This option prints statistics for vector and waveform data. The appropriate data set should be selected before any of options (00) - (06) are invoked.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 VECTOR STATS	5-00-01
01 DIF BETW MEANS	5-01-01
02 COVARIANCE MATRX	5-02-01
03 CORRELATN MATRX	Not Implemented
04 WAVE DATA MEAN	"
05 WAVE DATA VAR	"
06 WAVE MIN/MAX	"
07 Blank	"
08 "	"
09 "	"
10 LIST TREES	2-00-01
11 SELECT DATA SET	8-13-01
12 DRAW TREE	2-05-01
13 GAUSSIAN NOISE	Not Implemented
14 RET INIT FRM	2-1
15 HARDCOPY	

STATAB

06

OPTION

00 - VECTOR STATS

GENERAL DESCRIPTION:

This option prints the minimum value, maximum value, range, mean value, and variance along each measurement for the current TREE/NODE and all lowest nodes of the current TREE/NODE. A list of class names that are non-overlapping along each measurement is also printed.

DIALOGUE:

None

ERROR MESSAGES:

< I/O ERROR >

Error encountered in attempting to read vector file or covariance file. User should insure that a current data set (Type 13) has been designated.

NEXT FRAME:

STATAB

STATAB

06

OPTION

01 - DIF BETW MEANS

GENERAL DESCRIPTION:

This option prints the names, mean difference vector, and corresponding Euclidean distance for all possible node pairs (senior and lowest) in the current TREE/NODE.

DIALOGUE:

None

ERROR MESSAGES:

< I/O ERROR >

Error encountered in attempting to read covariance file.

User should insure that a current data set (Type 13) has been designated.

< ERROR - NO LONGER NODES >

The current node is a lowest node. A senior or intermediate node should be selected.

NEXT FRAME:

STATAB

STATAB

06

OPTION

02 - COVARIANCE MATRX

GENERAL DESCRIPTION:

This option prints the upper half of the symmetric covariance matrix of the node designated by the user.

DIALOGUE:

System:

< TYPE IN 6 CHAR NODE NAME >

User:

Type a six character node name. The node must be in the current TREE. A carriage return will designate the current node.

ERROR MESSAGES:

< I/O ERROR >

Error encountered in attempting to read covariance file. User should insure that a current data set (Type 13) has been designated.

NEXT FRAME:

STATAB

SECTION 6

OUTPUT DATA FRAME

Frame Name: IOPRNT

Call Sequence: 07

IOPRNT

OUTPUT DATA FRAME

GENERAL DESCRIPTION:

This frame is composed of one select option, one return option, and fourteen output options. Eight send information to the line printer, four save files on tape, and two present a Vector General display.

When outputting data to the line printer it is essential that the line printer be turned on and on-line; similarly for outputting to mag tape. See option description if tape unit should be on 0 or 1.

<u>MENU</u>	<u>DESCRIPTION ON PAGE</u>
00 - PRINT DIRECTORY	6-00-01
01 - PRINT TREES	6-01-01
02 - PRINT TR TABLES	6-02-01
03 - PRINT HEADER INFO	6-03-01
04 - PRINT WAVE	6-04-01
05 - PRINT VEC	6-05-01
06 - PRINT TREE/NODE	6-06-01
07 - PRINT IDS	6-07-01
08 - OUTPUT WAVE TAPE	6-08-01
09 - OUTPUT VEC TAPE	6-09-01
10 - SAVE TR ON TAPE	6-10-01
11 - SAVE LOGIC TREE	6-11-01
12 - LIST TREES	2-04-01
13 - SELECT DATA SET	8-13-01
14 - DRAW TREES	2-05-01
15 - RET TO INIT FRM	

OPTION

00 - PRINT DIRECTORY

GENERAL DESCRIPTION:

This option is more useful for program development than for the user.

The option outputs the WPS data directory and, optionally, the overlay directory, the USAG11 table, and the sector table (SECTBL) to the line printer. The output numbers may be in either octal or decimal - the user decides.

The data directory gives information as to the files' addresses, number of waveforms (vectors) per node, number of sectors, senior or lowest node indication, and digitization rate for senior nodes. It also shows whether the Q-bit (see Software Documentation) is set. If it is, then the value under ADDR is the offset to its entry in the sector table. The overlay directory gives mainly the name of the file and the number of sectors.

Each entry in the USAG11 table consists of a beginning and end address of an unused section of the RP04 or RP02 disk. All the entries are sorted as they are output to the line printer. The numbers immediately following the disk addresses give the actual position of the entry in the table. Like the directories, there are two USAG11 tables - one for data and one for overlays.

SECTBL shows the linkage of sections on the RP04 or RP02 used for one file. The offset indicator gives the number of bytes needed to be added to the SECTBL address to point to the entry. If the offset value to the next entry is 0, then there are no more entries.

DIALOGUE:

System:

< OCTAL PRINTOUT - HIT 0 >

User:

Enters "0" to output all numbers in octal form. Carriage return equals decimal printout.

System:

< ALL TABLES - HIT A >

User:

If the user does not enter A, he will receive only a printout of the data directory (sector 1 on the RP04 or RP02). If he enters A he will get the overlay directory (sector 0), the USAG11 tables (sectors 2 and 4), and SECTBL (sector 3). Usually the directories have extensions on to other sectors. The data directory extends from 1 to 20-99; the overlay directory extends from 0 to 10-19.

ERROR MESSAGES:

< RP02 ERROR >

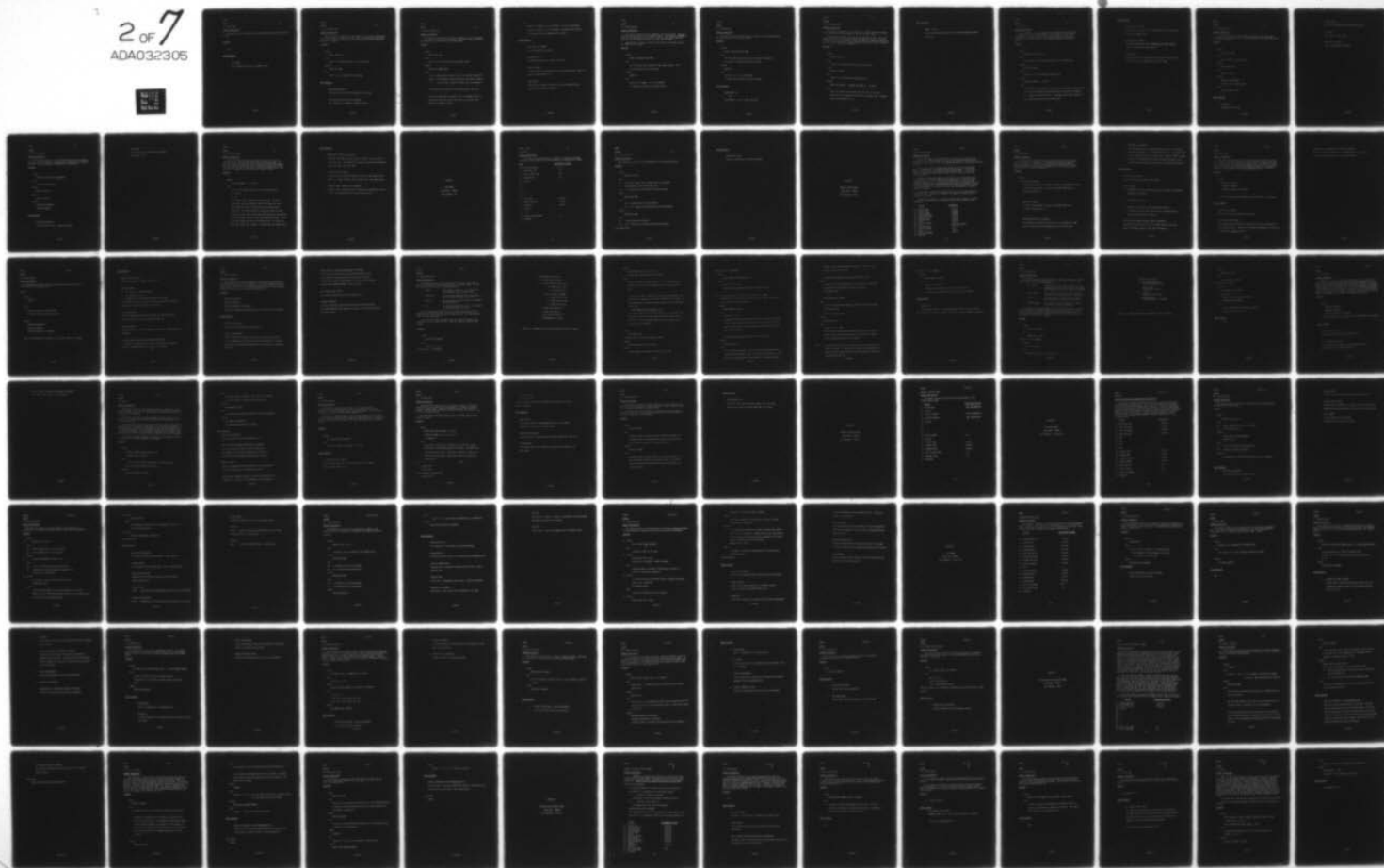
This message refers either to the RP02 or RP04.

AD-A032 305

PATTERN ANALYSIS AND RECOGNITION CORP ROME N Y F/G 9/2
THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM --ETC(U)
SEP 76 P K SANYAL, C BERSTER, T MCGIBBON F30602-72-C-0193
PAR-76-6 RADC-TR-76-224-VOL-2 NL

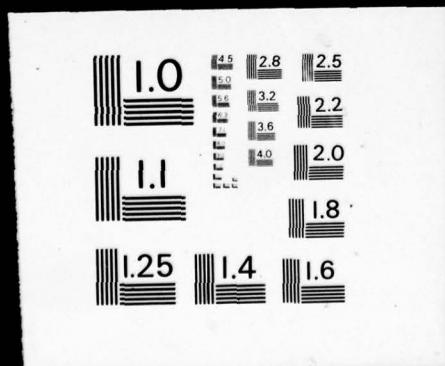
UNCLASSIFIED

2 OF 7
ADA032305



2 OF 7

ADA032305



IOPRNT

OPTION

07

01 - PRINT TREES

GENERAL DESCRIPTION:

This option lists tree names and their associated tree text on the line printer.

DIALOGUE:

None

ERROR MESSAGES:

< RP02 ERROR >

This message may indicate a hardware error.

6-01-01

IOPRNT

OPTION

07

02 - PRINT TREE TABLE

GENERAL DESCRIPTION:

For the tree name entered, its tree structure is printed schematically on the line printer. Nodes of the same level are printed directly beneath each other. Nodes of a lower level are printed with a greater indentation from the left margin.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

Enters 63 for waveform tree, 13 for vector tree

System:

< ENTER TREE NAME >

User:

Enters up to 6 characters for tree name

ERROR MESSAGES:

< TREE DOES NOT EXIST >

The tree is not in the WPS directory at this time.

< THIS TREE DOES NOT HAVE ANY LOW NODES >

This classifies a seemingly incomplete output.

IOPRNT

OPTION

07

03 - PRINT HEADER INFO

GENERAL DESCRIPTION:

This option outputs waveform header information to the line printer. A serial number keeps track of the number of waveforms output; otherwise, all information is taken directly from the header.

DIALOGUE:

System:

< ENTER TREE NAME >

User:

Enters up to six characters and carriage return

System:

< ENTER NODE NAMES CR=ALL >

User:

The node names entered need not be all of uniform 5-character length. The separators between names must be either a comma or a " ". Thus, an input string like NODE1 a,n1 is acceptable.

A carriage return stands for all lowest nodes in the tree.

If only one node name is entered, or if a carriage return is entered and only one lowest node exists in the tree, then:

< ENTER ID IF WANTED. CR=ALL >

User:

Enters an ID number 0 \leq ID \leq 2147483847, if only one waveform header is desired. ID is an integer. Carriage return outputs all headers of all the waveforms in the node.

ERROR MESSAGES:

< FILE CANNOT BE OPENED >

A node entered does not exist.

< NONEXISTENT ID >

The waveform ID does not exist in the node.

< FILE NOT FOUND >

Actually means an incompatible file structure was found. That, or else the sampling rate is 0.

< INPUT ERROR >

Either the tree cannot be found or else the waveform ID was entered with illogical characters.

IOPRNT

OPTION

07

04 - PRINT WAVEFORM

GENERAL DESCRIPTION:

This option outputs an entire waveform to the line printer. The data reflects the scale factor in the waveform header. The exponent (EXPONENT=) output to the printer is a power of ten. All the data output should be multiplied by the exponent in order to obtain the raw value.

Waveform text, if any, is output to the printer on the same line as the identification number.

DIALOGUE:

System:

< ENTER 6-CHARACTER NODE NAME >

User:

The tree symbol must precede the node name entered. Up to six characters in all are entered.

System:

< ENTER ID >

User:

Enters N, an integer $0 \leq N \leq 2147483847$

No commas are allowed in the input string.

IOPRNT

OPTION

07

05 - PRINT VECTOR

GENERAL DESCRIPTION:

This option outputs a vector which is entered via a 6-character node name and a vector ID to the line printer.

DIALOGUE:

System:

< ENTER 6-CHARACTER NODE NAME >

User:

The tree symbol must precede the node name which may be any number of characters from one to five.

System:

< ENTER ID >

User:

Enters ID no. ≤ 0 ID ≤ 2147483847

No commas are allowed in the input string.

ERROR MESSAGES:

< NONEXISTENT ID >

and

< INPUT ERROR > due to a faulty ID input.

OPTION

06 - PRINT TREE/NODES

GENERAL DESCRIPTION:

This option outputs to the line printer all header and data belonging to all waveforms or vectors under one or all nodes of a tree.

The user must be wary of outputting too much data at once. Once the outputting starts, files are left open until execution stops. If the user terminates this option by system control key CNTRL-X, he may find difficulty in using options within this frame, depending upon where the exit occurred. In such a case, rebooting is necessary.

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

Enters 63 for waveform data, 13 for vector data

System:

< ENTER TREE NAME >

User:

Enters up to six characters followed by CR.

System:

< ENTER NODE NAME(S). SEPARATE BY COMMA OR CR=ALL >

User:

Enters any number of node names that will fit on one line.

Each name must be between one and five characters long. Carriage return alone stands for all.

ERROR MESSAGES:

< ERROR ON INPUT >

A node entered does not exist or the input string had illegal
separators.

IOPRNT

OPTION

07

07 - PRINT IDS

GENERAL DESCRIPTION:

Either waveform or vector identification numbers are output to the line printer. All the IDs belonging to a particular node are printed out under the node name header. Either one or several or all nodes of a particular tree may have their corresponding waveform or vector IDs output.

DIALOGUE:

System:

< ENTER DATA TYPE OF TREE >

User:

Enters either 63 for waveform data or 13 for vector data.

System:

< ENTER TREE NAME >

User:

Enters up to six characters followed by CR.

System:

< ENTER NODE NAME(S). CR=ALL >

User:

Enters from one to as many as can fit on one line node names each from one to five characters and separated from each other by a comma or a < , ended by a carriage return. Carriage return alone stands for all lowest nodes under the particular tree.

ERROR MESSAGES:

< TREE___ DOES NOT EXIST >

The user must re-select this or another option if this or the following messages occur:

< FILE CANNOT BE OPENED >

This may be caused by a user terminating an output option before completion by hitting CNTRL-X.

< SYSTEM ERROR >

Usually means a zero sampling rate was found or else a file's data structure is incompatible to the WPS format.

IOPRNT

OPTION

07

08 - OUTPUT WAVE TAPE

GENERAL DESCRIPTION:

This routine allows the user to write a specified tree on mag tape. In doing so, it transforms the tree from disk format to WPS tape format making it "LODWAY" compatible.

DIALOGUE:

System:

< ENTER TREE NAME >

User:

Enter desired tree name and CR.

System:

< ENTER DATA TYPE >

User:

Enter 63 and CR.

System:

< TRANSFER IN PROGRESS >

< ANOTHER TREE? - Y=YES, CR=NO >

User:

"Y" then "CR" or "CR"

ERROR MESSAGES:

< EOT ERROR >

Unexpected end of tape.

6-08-01

< RETRIEVE ERROR >

Fatal filing system error, check data structure

< I/O ERROR >

Fatal "GET" or "PUT" error.

< DISK BLOCK TOO LONG >

Block length greater than 4096.

OPTION

10 - SAVE TR ON TAPE

GENERAL DESCRIPTION:

This routine transfers a user-specified waveform tree to magnetic tape, and stores it there in a format which is compatible with overlay "TXDISK". (See WPS Software Documentation for the format.)

DIALOGUE:

System:

< ENTER TREE NAME TO BE TRANSFERRED >

User:

Enter tree name and CR

System:

< ENTER DATA TYPE >

User:

Enter 63 and CR

System:

< TRANSFER IN PROGRESS >

< TRANSFER COMPLETE >

ERROR MESSAGES:

< FILING SYSTEM ERROR >

System retrieval error - operation aborted

< EOT ERROR >

Unexpected end of tape marker encountered

Next frame: N/A

6-10-02

IOPRNT

OPTION

07

11 - SAVE LOGIC TREE

GENERAL DESCRIPTION:

This option transfers logic trees (data types 20, 21, and 22) requested by the user from the system disk to 9-track mag tape. All logic tree names on the system disk are displayed on the Vector General before the system requests user input. Before exercising this option, a 9-track mag tape must be loaded onto a 9-track tape drive unit. The tape drive unit must be on line and on unit select 0 (zero).

DIALOGUE:

System:

LOGIC TREE NAME <CR> TO EXIT

User:

The user will respond with one of the following options

(a) name CR

(b) CR

where NAME is any 6 character logic tree name. The first option will cause the system to store the input logic tree name (NAME) and return to ask the user for another logic tree name. The second option will cause the system to begin moving all logic trees, whose names have been input, from system disk to mag tape, unless no logic tree names were input. If no logic tree names were input, the system exists. If logic tree names were input, the transfer is completed and the system exits.

ERROR MESSAGES:

< NAME DOESN'T EXIST ON THE DISK >

Indicates that NAME, an input logic tree name, does not exist on the system disk. The system will continue to process the remaining logic tree names that were input.

< YOU ARE AT END OF TAPE >

Indicates that the system attempted to write on mag tape but was unable to because there was no more space left. The system exits.

< HARDWARE ERROR: NAME DID NOT TRANSFER >

Indicates that a hardware error occurred while attempting to access a file. The system writes an end of file and exits.

SECTION 7

WPS FRAME

Frame Name: FUNCT

Call Sequence: 08

FRAME: FUNCT

08

WPS FRAME

GENERAL DESCRIPTION:

This frame essentially provides a transfer to Single Wave Display, Multi Wave Display, Wave to Wave Transformations and Segmentation Frames.

<u>MENU</u>	<u>DESCRIPTION ON PAGE</u>
00 - SINGLE WAVE/EDIT	8-1
01 - MULTI WAVE INIT	12-1
02 - WAVE TO WAVE TRANS	14-1
03 - SEGMENTATION	18-1
04 - (blank)	
05 - "	
06 - "	
07 - "	
08 - "	
09 - LIST TREES	2-04-01
10 - SELECT DATA SET	7-10-01
11 - DRAW TREE	2-05-01
12 - (blank)	
13 - "	
14 - RETURN TO INIT FRAME	2-1
15 - HARDCOPY	

FUNCT

OPTION

08

10 - SELECT DATA SET

GENERAL DESCRIPTION:

User identifies a data set to be designated as "the current data set."

DIALOGUE:

System:

< ENTER DATA TYPE >

User:

(a) any number ranging from 0 through 255 may be entered
corresponding to the desired data type.

(b) < CR > implies use the previous data type selected.

System:

< ENTER TREE NAME >

User:

(a) 6 characters or less are entered.

(b) < CR > implies use the previous tree name selected.

System:

< ENTER NODE NAME >

User:

(a) 5 character name is entered.

(b) < CR > implies use the previous node name selected.

end transactions

7-10-01

ERROR MESSAGES:

< NON-EXISTENT FILE >

Data set selected does not exist; reselect.

SECTION 8

SINGLE DISPLAY FRAME

Frame Name: SINGLE

Call Sequence: 08-00

SINGLE

08-00

SINGLE DISPLAY FRAME

GENERAL DESCRIPTION:

Within this frame the user may select a data set, if he has not done so already in the Initial Frame, and display the waveforms from that data set on the Vector General (VG). It displays one signal at a time from a selected data set.

The user may choose to display the waveforms in order (see DISPLAY NEXT) or sequentially (see SELECT SEQUENCE) or he may opt to display any particular waveform by identifying it (see DISPLAY NAMED). If the user wishes, he may display waveforms in backward order in the data set (see DISPLAY PREVIOUS).

Whenever a waveform's length is such that it is not displayed all at one time on the VG, the user may invoke CONTINUE WAVE to view succeeding displays (pages) of it. To view the same page that is currently being displayed, perhaps because new scaling features have been entered, the user may invoke DISPLAY SAME. HORIZONTAL SCALE and VERTICAL SCALE each contain four modes from which to choose to set new scaling parameters in order to modify the display.

For automatic viewing of a complete data set, the user may invoke the SCROLL function. Waveforms are automatically paged and viewing time is selected by the user.

Permanent modification to the waveform data itself while it is being displayed is accomplished in the Waveform Editing Frame (WVFEDT) under option EDIT.

<u>OPTIONS</u>	<u>DESCRIPTION</u>
00 - DISPLAY NEXT	8-00-01
01 - DISPLAY SAME	8-01-01
02 - DISPLAY NAMED	8-02-01
03 - DISPLAY PREVIOUS	8-03-01
04 - HORIZONTAL SCALE	8-04-01
05 - VERTICAL SCALE	8-05-01
06 - CONTINUE WAVE	8-06-01
07 - SCROLL	8-07-01
08 - SELECT SEQUENCE	8-08-01
09 - ZOOM	[Not Implemented]
10 - SEL START TIME	8-10-01
11 - XTENDED OPTIONS	9-1
12 - EDIT	10-1
13 - SELECT DATA SETS	8-13-01
14 - RET TO WPS FRAME	7-1
15 - HARDCOPY	

SINGLE

08-00

OPTION

00 - DISPLAY NEXT

GENERAL DESCRIPTION:

This option will display the first or next waveform from the current data set on the VG. Ordinarily, the immediately following waveform is displayed; however, if the user has selected an NTH sequence value (see SELECT SEQUENCE) the waveform next displayed will be in the NTH position away from the one currently displayed.

DIALOGUE:

System:

< WAVEFORM INCOMPLETE >

To display next page of waveform, user must hit CONTINUE WAVE (06).

To display new waveform, user must hit DISPLAY NEXT (00) or
DISPLAY PREVIOUS (03).

< WAVEFORM COMPLETE >

To display new waveform, user must hit DISPLAY NEXT (00)
or DISPLAY PREVIOUS (03).

< WAVEFORM RETRIEVAL IN PROGRESS >

This message is displayed if and only if the waveform is longer
than 65K points and the horizontal scale is in "fit" mode.

< END INPUT FILE REACHED >

The next waveform to be displayed does not exist - the user may invoke DISPLAY SAME (01) or DISPLAY PREVIOUS (03). If DISPLAY NEXT (00) is invoked, the user will receive an < ERROR ON INPUT > message and will be prohibited from further displaying any part of the current data set, which must be re-selected (SELECT DATA SET)(13).

ERROR MESSAGES:

< DATA SET NOT SELECTED >

User must invoke option SELECT DATA SET(13)

< ERROR ON INPUT >

1. DISPLAY NEXT (00) was invoked after the "END INPUT FILE REACHED" message was displayed.

2. The sampling rate is 0.

3. Inherent file structure incompatibility with WPS.

To recover from this error (any of the 3 conditions above), the user must re-select a data set.

< TIME (OR FREQ.) SELECTED BEYOND RANGE OF WAVEFORM >

To recover, the user should go to SEL START TIME (10) and enter either a carriage return or a new time or frequency.

SINGLE

08-00

OPTION

01 - DISPLAY SAME

GENERAL DESCRIPTION:

This option will re-display the currently displayed waveform starting from either the same time or frequency that starts the currently displayed page or from a new time or frequency selected by the user after the current page was displayed. This option makes possible viewing the same data with different scaling features as chosen in HORIZONTAL SCALE (04), VERTICAL SCALE (05), or elsewhere in the editing module EDIT (12).

DIALOGUE:

System:

< WAVEFORM INCOMPLETE >

< WAVEFORM COMPLETE >

< WAVEFORM RETRIEVAL IN PROGRESS >

These three messages are described in the DISPLAY NEXT (00) dialogue.

ERROR MESSAGES:

< DATA SET NOT SELECTED >

User must invoke option SELECT DATA SET (13)

< HIT "DISPLAY NEXT" FIRST >

This message appears whenever no waveform has yet been displayed from the current data set. There may be a waveform displayed on the VG, but it is not from the current data set.

< TIME (OR FREQ.) SELECTED BEYOND RANGE OF WAVEFORM >

To recover, the user should go to SEL START TIME (10) and enter either a carriage return or a new time or frequency.

SINGLE

08-00

OPTION

02 - DISPLAY NAMED

GENERAL DESCRIPTION:

By invoking this option, the user may display any waveform from the current data set by entering its ID.

DIALOGUE:

System:

< ENTER ID >

User:

Enters ID number $0 \leq ID \leq 214748384$ >

No commas should be entered in the ID.

System:

< WAVEFORM INCOMPLETE >

< WAVEFORM COMPLETE >

< WAVEFORM RETRIEVAL IN PROGRESS >

These three messages are described in the DISPLAY NEXT (00) dialogue.

ERROR MESSAGES:

< DATA SET NOT SELECTED >

User should proceed to SELECT DATA SET (13)

< ERROR ON INPUT >

1. The ID was not entered properly.
2. The sampling rate is 0.
3. Inherent file structure incompatibility with WPS.

If the error was due to (1) the user need not re-select a data set as he must if the error was due to (2) or (3).

< NO SUCH WAVEFORM >

The ID entered does not match any within the current data set.

The user does not have to re-select the data set.

< RP02 READ ERROR >

Usually fatal, but the user technically still has a current data set selected.

< TIME (OR FREQ.) SELECTED BEYOND RANGE OF WAVEFORM >

To recover, the user should go to SEL START TIME (10) and enter either a carriage return or a new time or frequency.

2

SINGLE

08-00

OPTION

03 - DISPLAY PREVIOUS

GENERAL DESCRIPTION:

This option will display the waveform existing before the presently displayed waveform in the current data set. If the NTH sequence value has been selected, the waveform to be displayed will be the NTH one backwards. Unlike DISPLAY NEXT (00), this option may display only up to the nineteenth waveform existing before the presently displayed one.

DIALOGUE:

- < WAVEFORM INCOMPLETE >
- < WAVEFORM COMPLETE >
- < WAVEFORM RETRIEVAL IN PROGRESS >

These three messages are described in the DISPLAY NEXT (00) dialogue.

ERROR MESSAGES:

- < DATA SET NOT SELECTED >

User must invoke option SELECT DATA SET (13)

- < BACKUP LIMIT REACHED >

DISPLAY PREVIOUS (03) cannot function at this time due to either (1) the beginning of the data set has been encountered (2) nineteen waveforms have already been skipped over or displayed in a backwards direction.

<TIME (OR FREQ.) SELECTED BEYOND RANGE OF WAVEFORM>

To recover, the user should invoke SET START TIME (10) and enter either a carriage return or a new time or frequency. He then should invoke DISPLAY SAME (01) to display the waveform desired when DISPLAY PREVIOUS (03) was invoked.

<HIT "DISPLAY NEXT" FIRST>

The current data set has not been displayed yet.

<ILLEGAL OPERATION>

Due to an extremely large data base the calculations performed by DISPLAY PREVIOUS have reached an overflow. The user may re-select any other option.

SINGLE

08-00

OPTION:

04 - HORIZONTAL SCALE

GENERAL DESCRIPTION:

This option allows a user to define the horizontal scaling mode in which every waveform will be displayed within the SINGLE frame. The user may select one of four modes: (See Figure 8-1).

- | | |
|---------------|--|
| 0. DEFAULT | These values become set: 512 points/line
4 lines/frame, point sequence (P)=1. |
| 1. UNITS/LINE | The user enters whatever value of seconds or Hertz he wants displayed on one line. |
| 2. EXPLICIT | The user enters N points/line, N lines/frame, and point sequence. |
| 3. FIT | The entire waveform will be fit on the number of lines specified by the user. |

If the user selects UNITS/LINE or the EXPLICIT mode, he is asked whether grid marks are desired. If they are, then the user must in the UNIT/LINE mode enter units per mark (in seconds or Hz) or in the EXPLICIT mode enter grid marks/line.

The horizontal scale mode and values, including grid marks, exist independent of the current data set. They are permanent features until changed.

DIALOGUE:

System:

< ENTER OPTION NUMBER >

User:

Enters 0, 1, 2, or 3

DIALOGUE (IF "1" IS ENTERED:)

HORIZONTAL SCALE OPTIONS

Ø - ACCEPT DEFAULT VALUES

1 - N UNITS PER LINE LABEL LIST:

M = MEGA (SECS OR HZ)

k = KILO (SECS OR HZ)

s or H = SECONDS OR HERTZ

m = MILLI (SECS OR HZ)

μ = MICRO (SECS OR HZ)

n = NANO (SECS OR HZ)

2 - M POINTS PER LINE (512)

N LINES PER FRAME (4)

PLOT EVERY PTH POINT (1)

3 - FIT WAVEFORM TO N LINES

FIGURE 8-1 HORIZONTAL SCALE OPTIONS DISPLAYED IN THE G.P. REGION

System:

< ENTER NUMBER SECS OR HZ PER LINE.>

< USE ONE LABEL FROM LABEL LIST (SEE ABOVE) >

User:

Enters an integer or decimal number. Up to 10 digits may be entered to the left of the decimal point and up to 9 on the right.

If this option number (UNITS/LINE) was selected previously, the user may hit a carriage return which preserves the old value. If a carriage return is entered, another question will be directed to the user:

< WANT MAXIMUM LINES DISPLAYED? HIT M >

The user may want the total lines possible to be displayed with the amount of seconds or Hertz he entered previously to be on each line. If not, whatever number lines per frame already existing will be displayed.

System:

< GRID MARKS Y-YES >

If user enters Y, then this dialogue follows:

System:

< ENTER NUMBER SECS OR HZ PER MARK >

User:

Number entered is integer or decimal, as per line.

DIALOGUE (If "2" IS ENTERED):

System:

< ENTER NUMBER OF POINTS PER LINE >

User:

Enters N $0 < N < 3415$

Carriage return preserves the old (or default) value.

NOTE: Any N greater than 1707 will cause a white-out on the display line on the VG, due to the fact that no other VG points can exist between the waveform points.

System:

< ENTER NUMBER OF LINES >

User:

Enters N $0 < N < 25$

The number of lines entered is also restricted in that the number of lines times the points per line must be less than or equal to 5120. The user will be asked to re-enter the explicit values if this limit is exceeded.

Carriage return preserves the old (or default) value.

System:

< ENTER VALUE OF P >

User:

"P" is the point sequence. If "2" is entered, then every other point will be displayed; if "3", then every third point, etc. The first (or starting) point of the waveform is always displayed,

however - the sequencing starts from there. "P" may be any positive integer up to 32767.

Carriage return preserves the old (or default) value.

System:

At this point the system asks one of two questions, depending upon whether grid marks have already been chosen:

< GRID MARKS Y-YES >

or

< GRID MARKS Y-YES S-SAME >

User:

If "S" is an appropriate response, then the grid marks already existing are kept.

If "Y" is entered, then:

System:

< MARKS PER LINE= >

User:

Enters N $0 < N \leq 2560$

If the number of grid marks entered above equals the number of points per line entered, then each grid mark will lie exactly under each waveform point on the display.

NOTE: The grid mark lying on the left border line on the display is an "extra" grid mark. It should not be counted when figuring grid marks, as neither should the first waveform point be counted when figuring points per line.

DIALOGUE (IF "3" IS ENTERED)

System:

< ENTER NUMBER OF LINES >

User:

Enters N $0 < N < 25$

Carriage return resets the old (or default) value.

The waveform is completely fit to N lines on the display.

ERROR MESSAGES:

< INPUT ERROR >

This message occurs if a bad character was entered in the seconds or Hertz response to option #1 request. User must re-select HSCALE light-button.

OPTION

05 - VERTICAL SCALE

GENERAL DESCRIPTION:

This option allows a user to define the vertical scaling mode in which every waveform will be displayed within the SINGLE frame. The user may select one of four modes: (See Figure 8-2).

- | | | |
|----|----------------|---|
| 0. | PAGE GLOBAL | The upper and lower bounds for each line are identical and equal to the maximum and minimum value displayed over all the lines on the page. |
| 1. | LOCAL SCALING | The bounds of each line are set to whatever max and min are being displayed on that line. |
| 2. | EXPLICIT | The user enters both upper and lower bound - each line will be scaled to these bounds. |
| 3. | WAVEFORM GLOBL | Each line is scaled according to the max and min value of the entire waveform. |

In addition to the above modes, the user may define the values of grid lines to appear on the display (lines parallel to the zero line). Up to twenty values may be entered. Like the horizontal grid marks, these vertically scaled grid lines exist independent of the current data set and are permanent features until changed.

DIALOGUE:

System:

< ENTER OPTION NUMBER >

User:

Enters 0, 1, 2, or 3

DIALOGUE IF "2" IS ENTERED:

System:

< ENTER MAX VALUE >

User:

Enters N, an integer $-2^{15} \leq N \leq 2^{15}-1$

VERTICAL SCALE OPTIONS

- Ø - PAGE GLOBAL (DEFAULT)
SCALE TO MAXIMUM ON PAGE
- 1 - LOCAL SCALING
SCALE TO MAX ON LINE
- 2 - EXPLICIT
USER SPECIFIED MIN/MAX
- 3 - WAVEFORM GLOBL
SCALE TO MAXIMUM IN WAVEFORM

FIGURE 8-2 VERTICAL SCALE OPTIONS DISPLAYED IN THE G.P. REGION

System:

<ENTER MIN VALUE >

User:

Same response as above

DIALOGUE FOR ALL OPTIONS:

System:

<GRID MARKS? Y-YES, N-NO >

If user enters Y:

<ENTER LEVELS AT WHICH MARKS DESIRED,
SEPARATE EACH BY COMMA >

User:

Enters integer values separated by commas;
for each N $-2^{15} \leq N \leq 2^{15}-1$

ERROR MESSAGES:

None

8-05-03

SINGLE

08-00

OPTION

06 - CONTINUE WAVE

GENERAL DESCRIPTION:

Whenever the user sees "WAVEFORM INCOMPLETE," he may display more points from the waveform being displayed by invoking CONTINUE WAVE (06). After the option has been invoked, the display will feature a new page of points which either succeed the points on the preceding page or else exist further along into the waveform due to a new start time being requested. CONTINUE WAVE (06) will not display a new start time if the point has been previously displayed on the screen. If such is the case, the user should select DISPLAY SAME (01) to display the requested start time.

DIALOGUE:

System:

< WAVEFORM INCOMPLETE >

< WAVEFORM COMPLETE >

< WAVEFORM RETRIEVAL IN PROGRESS >

These three messages are described in the DISPLAY NEXT (00) dialogue.

ERROR MESSAGES:

< DATA SET NOT SELECTED >

User must invoke option SELECT DATA SET (13)

< HIT "DISPLAY NEXT" FIRST >

The current data set needs to be displayed either by
DISPLAY NEXT (00) or DISPLAY NAMED (02).

< TIME (OR FREQ.) SELECTED BEYOND RANGE OF WAVEFORM >

Go to SELECT START TIME (10) for recovery.

8-06-02

SINGLE

08-00

OPTION

07 - SCROLL

GENERAL DESCRIPTION:

This option allows the user to page through the current data set in one of two ways. Either all the pages from all the waveforms (or from the currently displayed one on) will be displayed or only one page from each waveform will be displayed.

If the user wants all the pages displayed he should enter a (1) to simulate the continue wave option (but through all the waveforms) to the end of the data set.

If the user wants only a certain page from each waveform displayed he should enter (0) to simulate display next. If a waveform is currently displayed at the time SCROLL is invoked, then the one page displayed from each succeeding waveform will begin with the same time or frequency as the one currently displayed. If no waveform is displayed at the time of the invocation, then the first page of each waveform will be the one displayed.

An automatic hardcopy function of each page to be displayed, whether it be one or all from each waveform, is available.

DIALOGUE:

System:

< SIMULATE REPEATED DISPLAY NEXT (0) OR
CONTINUE WAVE (1) MODES? >

User:

A 0 or 1 must be entered followed by a carriage return.

Any other response aborts the option.

System:

< TYPE # OF SECONDS TO DELAY >

8-07-01

User:

An integer number is entered. This will be the viewing time in seconds the user will have of each page.

System:

< AUTO-HARDCOPY Y=YES >

User:

Y entered gives automatic hardcopy of each page displayed.

System:

< END INPUT FILE REACHED >

All scrolling ends with this message.

ERROR MESSAGES:

< DATA SET NOT SELECTED >

User must invoke option SELECT DATA SET (13)

< TIME (OR FREQ.) SELECTED BEYOND RANGE OF WAVEFORM >

Scrolling aborts but current data set stays open.

This happens usually when the display next function is simulated and the waveforms differ greatly in length.

< ERROR ON INPUT >

Either an incompatible waveform format has been encountered or, more specifically, a 0 sampling rate exists.

This message is not given when the user enters something else besides 0 or 1 in reply to the simulation of modes question.

SINGLE

08-00

OPTION

08 - SELECT SEQUENCE

GENERAL DESCRIPTION:

This option allows the user to select an nth sequence value. Every waveform then displayed will be at an nth position from the last displayed. The number entered must be a positive integer. To go backwards n waveforms the user can enter DISPLAY PREVIOUS (03).

Regardless of whatever number n is, the first waveform of the current data set is always the first one displayed by DISPLAY NEXT (00). Sequencing commences after this first display. The nth value lasts as long as WPS is in core.

DIALOGUE:

System:

< N = EVERY NTH WAVE. ENTER N >

User:

A positive integer is entered. $0 < N < 256$

ERROR MESSAGES:

<N = EVERY NTH WAVE. ENTER N>

Number selected was 255. User should enter another number.

Carriage return sets N to 1.

SINGLE

08-00

OPTION

10 - SEL START TIME

GENERAL DESCRIPTION:

By invoking this option the user can request a time, or frequency, from which the next waveform will be displayed. To display a currently displayed waveform from a requested value DISPLAY SAME (01) should be invoked. (CONTINUE WAVE (06) may be invoked as long as the requested time has not been displayed yet.)

The user should note that decimal as well as integer values can be accepted as input.

DIALOGUE:

System:

<ENTER START TIME (OR FREQ). USE ONE

LETTER FOR LABEL: M, K, s or H, m, μ , n

CR = DEFAULT >

User:

User enters a value up to 10 digits on the left and 9 digits to the right of the decimal point (if entered). The number must be followed by one label. Each label represents a power of 10 which will be multiplied by the value entered to compute the actual value:

09 -

08-00

M = Mega (10^6)

K = Kilo (10^3)

S or H = seconds or Hertz (10^0)

m = milli (10^{-3})

μ = micro (10^{-6})

n = nano (10^{-9})

μ can be entered from the Vector General by typing the M and the SPEC key together.

ERROR MESSAGES:

< INPUT ERROR >

The user has entered a non-standard label on a non-numeric character or more than one decimal point.

< DATA SET NOT SELECTED >

User must enter a current data set in option SELECT DATA SETS (13).

< PROGRAM ERROR >

The current data set is probably not structured according to the WPS format.

SINGLE

08-00

OPTION

13 - SELECT DATA SETS

GENERAL DESCRIPTION:

By invoking this option, the user defines the current data set, the data set which is displayed and edited, and which accepts display modifications of requested starting or sequence values.

The current data set is defined by a tree name and any node which exists under the tree, including the five-character senior node name (the last five characters of the tree name).

DIALOGUE:

System:

< ENTER TREE NAME >

User:

Response is any tree name up to six characters followed by a carriage return or a carriage return itself which duplicates the existing tree name in the current data set.

System:

< ENTER NODE NAME >

User:

Response is any node name within the tree just selected up to five characters followed by a carriage return or a carriage return itself which duplicates the existing node name in the current data set.

ERROR MESSAGES:

< NON-EXISTENT FILE >

Either the tree and/or node name entered does not exist.

User must re-invoke the SELECT DATA SETS (13) option.

SECTION 9

EXTENDED OPTIONS FRAME

Frame Name: EXTOPN

Call Sequence: 08-00-11

EXTOPN

08-00-11

EXTENDED OPTIONS FRAME

GENERAL DESCRIPTION:

This frame includes the options which are additional to the SINGLE DISPLAY frame.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - LIST COORDS	[Not Implemented]
01 - (blank)	
02 - DISP CALC MARKS	[Not Implemented]
03 - DISP APR MARKERS	[Not Implemented]
04 - (blank)	
05 - "	
06 - "	
07 - "	
08 - WAVE PLAYBACK	10-1
09 - (blank)	
10 - DISPLAY NEXT	8-00-01
11 - DISPLAY SAME	8-01-01
12 - CONTINUE WAVE	8-06-01
13 - RET TO SINGLE WAVE	8-1
14 - RETURN TO WPS	7-1
15 - HARDCOPY	

SECTION 10

PLAY BACK FRAME

Frame Name: PLAYBK

Call Sequence: 08-00-11-08

PLAYBK

08-00-11-09

PLAYBACK

GENERAL DESCRIPTION and PREPARATION INSTRUCTIONS:

The user is given the opportunity to listen to acoustic waveform data via loudspeaker or headphone set. Any of the 16 available D/A converters (DAC) in the hybrid AD/5 computer may be selected. The user is responsible for patching the output of the DAC to a trunk line on the AD/5 patch board and then connecting the trunk line outlet to any audio amplifier-loudspeaker/headphone. (The input terminal of the DAC should be patched to a 10-volt source, marked +1 on the board. Refer to the Final Report for Contract #F30602-74-0293, "Speech Module Additions to WPS", PAR Report No. 75-5, for more detail).

OPTIONS	DESCRIPTION
00 - PLAY THIS PART	10-00-01
01 - PLAY THIS WAVE	10-01-01
02 - PLAY A NEW WAVE	10-02-01
03 - LIGHT PEN PLAY	10-02-01
04 - ***	
05 - ***	
06 - ***	
07 - ***	
08 - DISPLAY SAME	8-01-01
09 - DISPLAY NEXT	8-00-01
10 - DISPLAY PREVIOUS	8-03-01
11 - DISPLAY NAMED	8-02-01
12 - RET TO EXT OPT	9-1
13 - RET TO SINGLE	8-1
14 - RET TO WPS FRAME	7-1
15 - HARDCOPY	

PLAYBK

08-00-11-08

OPTION

00 - PLAY THIS PART

GENERAL DESCRIPTION:

The user may listen to the page of waveform data last displayed from the Single Wave Display Module.

DIALOGUE:

System:

< ENTER DAC NO. (0-15) >

User:

- (a) Number ranging from 0 to 15 is entered.
- (b) <CR> indicates DAC 0.

System:

Plays back last page displayed.

< REPEAT? (Y,N) >

User:

- (a) "n" or "N" indicates end transactions.
- (b) Anything else repeat playback.

System:

If response to :Q1: was (b) then revert to :Q1:, otherwise

ERROR MESSAGES:

< DATA SET NOT SELECTED >

No current data set has been declared.

10-00-01

<ILLEGAL OPTION>

There is no current display (from Single Wave Display).

<ILLEGAL PLAYBACK RATE>

Sampling rate of waveform is too large; limit is 32767 Hertz.

Reduce take-through Horizontal Scale options in Single-Display.

<CLOCK JAMMED >

Possible hardware (AD/5) problem.

Clear and reset the board; try again.

PLAYBK

08-00-11-08

OPTION

01 - PLAY THIS WAVE

GENERAL DESCRIPTION:

The user may listen to the entire waveform or any segment of the waveform which is currently displayed from the Single Wave Display Module.

DIALOGUE:

System:

S1 <ENTER DAC NO. (0-15) >

User:

(a) Number ranging from 0 to 15 is entered.

(b) <CR> indicates DAC 0 is to be used.

System:

S2 <START FROM BEGINNING TO END? (Y, N) >

User:

(a) "Y" or "y" indicates play back entire wave.

(b) Anything else implies designate a segment of the waveform to be played back.

S3 System:

If response to :Q2: was (a) then skip to :S5:

< ENTER START TIME >

User:

Double precision number is entered followed by a time units symbol; e.g. 14.7358m (milli-seconds) limit is F10.q format; input must be within the waveform domain.

10-01-01

S4 System:

< ENTER END TIME >

User:

Same response as above will be interpreted as the end time
for the wave play back.

S5 System:

< WAVEFORM PREPARATION IN PROGRESS >

end transactions

ERROR MESSAGES

< DATA SET NOT SELECTED >

No current data set has been declared. Select data set.

< ILLEGAL OPTION >

No waveform has yet been displayed. Back to Single-Display.

< ILLEGAL PLAYBACK RATE >

Sampling rate of waveform is greater than 32767 Hertz.

Reduce sampling rate.

< PROGRAM ERROR >

Fatal: Inconsistency in programming logic will cause this message.

< PROGRAM OR DISK ERROR >

Fatal: Possibility of a disk access error (hardware) or (D) above.

10-01-02

< ILLEGAL INPUT >

Response to either :S3: or :S4: was illegal; retry.

< FILE ERR >

Fatal: Attempt to create an intermediate file has failed;
possibly disk has no free sectors.

< DISK ERR >

Fatal: A disk read command failed - hardware fault.

10-01-03

PLAYBK

08-00-11-08

OPTION:

02 - PLAY A NEW WAVE

GENERAL DESCRIPTION:

Any waveform on the disk may be selected for playback. The user identifies any waveform by designating tree, node, and wave ID.

DIALOGUE:

System:

< ENTER DAC NO. (0-15) >

User:

0 through 15 may be entered or <CR> implies DAC 0.

System:

< ENTER TREE NAME >

User:

(a) 6 characters or less are entered.

(b) <CR> identifies the current tree.

System:

< ENTER NODE NAME >

User:

(a) 5 characters or less are entered.

(b) <CR> identifies the current node.

System:

< ENTER WAVEFORM ID >

10-02-01

User:

10 digits or less are entered corresponding to a waveform ID.

System:

< WAVEFORM PREPARATION IN PROGRESS >

ERROR MESSAGES:

< NON-EXISTENT FILE >

File requested is not listed in the data directory.

< NON-EXISTENT ID >

Waveform requested could not be found under the designated file.

< ILLEGAL PLAYBACK RATE >

Sampling rate of waveform is greater than 32767 Hz. Reduce
sampling rate.

< PROGRAM ERROR >

Fatal error - programming logic failed. Contact maintenance.

< PROGRAM OR DISK ERROR >

Fatal error - disk access fault (hardware) or (D) above.

< FILE ERR >

Fatal error - attempt to create an intermediate file has failed.

Possibly, disk has no free sectors.

< DISK ERR >

Fatal error - a disk read command failed (hardware fault).

10-02-03

PLAYBK

08-00-11-08

OPTIONS

03 - LIGHT PEN PLAY

GENERAL DESCRIPTION:

The user may listen to some portion of the currently displayed waveform by light-gunning the segment desired (beginning and end coordinates).

DIALOGUE:

S1 System:

< HIT A POINT ON THE WAVEFORM >

User:

Light-gun a point on the wave.

S2 System:

Marks point with a cross.

< HIT LEFT OF X TO REJECT - RIGHT TO ACCEPT >

User:

Light-gun again according to instructions to reject or accept the coordinate designated.

S3 System:

If coordinate was rejected then cross is deleted and control goes to :S1:, otherwise

< HIT ANOTHER POINT >

User:

Light-gun a different point on the wave.

S4 System:

Marks point with a cross

10-03-01

< HIT LEFT OF X TO REJECT-RIGHT TO ACCEPT >

User:

Light-gun according to instructions to reject or accept
the coordinate designated.

System:

If coordinate was rejected the cross is deleted and control
goes to :S3:;, otherwise, a segment has now been specified by
the two crosses on the screen and the playback will be heard
almost immediately after the following.

< ENTER DAC NO. (0-15) >

User:

0 through 15 is entered corresponding to the board patch.

<CR> implies DAC 0.

end transactions

ERROR MESSAGES:

< DATA SET NOT SELECTED >

No data set has been declared; select data set and display.

< ILLEGAL OPTION >

A data set has been declared but no display has been
invoked. Display the requested page first.

< ILLEGAL HIT >

A coordinate other than a waveform point has been light-gunned

10-03-02

or same coordinate has been designated twice. (One point cannot be played back.)

< VGBUF OVERFLOW >

The display buffer cannot accomodate the light-gunning code; redisplay same page but minus 15 points (through Horizontal Scale option 2).

< ILLEGAL PLAYBACK RATE >

Effective sampling rate of displayed waveform is too large (> 32767); reduce the ESR through the Horizontal Scale option 2.

< CLOCK JAMMED >

Possible hardware (AD/5) problem; check patch board and try again after initializing on AD/5.

SECTION 11

EDIT FRAME

Frame Name: WVFEDT

Call Sequence: 08-00-11-08

WAVEFORM EDITING MODULE

GENERAL DESCRIPTION:

This frame accompanies the "single" display module in that a waveform must be displayed on the VG prior to invoking any of the edit functions. All of the options allow the user to edit the waveform in some way. These alterations become permanent file structure modifications.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - CHANGE WAVEFORM ID	11-00-01
01 - MODIFY TEXT	11-01-01
02 - TRUNCATE BACK	11-02-01
03 - TRUNCATE FRONT	11-03-01
04 - INSRT APR SET MK	11-04-01
05 - SPCIFY TEMP SYMB	11-05-01
06 - SEGMENT WAVEFORM	11-06-01
07 - DELETE WAVEFORM	11-07-01
08 - ***	
09 - MODIFY TIME REF	11-09-01
10 - CONTINUE WAVE	8-06-01
11 - DISPLAY SAME	8-01-01
12 - DISPLAY NEXT	8-00-01
13 - RET TO SIN FRAME	8-1
14 - RET TO WPS FRAME	7-1
15 - HARDCOPY	

OPTION

00 - CHANGE WAVEFORM ID

GENERAL DESCRIPTION:

This option allows the user to specify a new ID for the waveform currently displayed on the VG. The new ID is permanently entered in each block leader of the current waveform. ID insertion may be verified by calling "Display Same".

DIALOGUE:

System:

< ENTER NEW ID >

User:

New ID is entered followed by a carriage return

A valid waveform ID is any number x, such that

$$0 \leq x \leq 2^{32} - 1 = 4\ 294\ 967\ 295$$

System:

< NEW HEADER INFO INSERTED >

ERROR MESSAGES:

< FILING SYSTEM ERROR, DATA SET SELECTED? >

Implies No Data Set Selected

WVFEDT

08-00-12

OPTION

01 - MODIFY TEXT

GENERAL DESCRIPTION:

This option allows the user to specify up to 60 characters of waveform text. This text is permanently entered in the text file corresponding to the waveform that is currently being displayed under 'Single'.

DIALOGUE:

System:

<ENTER UP TO 60 CHARACTERS OF WAVEFORM TEXT >

User:

User enters text. Any VG keyboard character is legal.

System:

<NEW TEXT INSERTED >

ERROR MESSAGES:

None

11-01-01

WVFEDT

08-00-12

OPTION

02 - TRUNCATE BACK

GENERAL DESCRIPTION:

This option allows the user to permanently eliminate all waveform points to the right of the cross-hair intersection point. The waveform being truncated is that which is currently displayed under the "single" module.

DIALOGUE:

System:

< POSITION X-HAIRS WITH CONTROL DIALS 1 & 2 THEN CARRIAGE RETURN >

User:

Aligns cross-hairs to desired truncation point.

Intersection of cross hairs indicates desired truncation point.

System:

< TRUNCATION IN PROGRESS >

ERROR MESSAGES:

1. < SECTORS NOT FOUND IN SECTBL >

A fatal error. Occurs when calculated address of sector containing truncation cannot be located when searching the sector table.

11-02-01

2. <I/O ERROR >

A fatal error occurring in the Input/Output routines, probably "GET" or "PUT".

3. <BYPASS LIMIT REACHED, TRUNCATION CONTINUES >

A non-fatal error; usually occurs when the waveform is displayed in a "FIT" mode. It merely indicates that system routine "BYPASS" was utilized to position the I/O pointer to the waveform start.

4. <FILING SYSTEM ERROR >

Filing system cannot find file in system tables.

5. <DATA SET NOT SELECTED >

6. <MARKER MISSED - REPOSITION X-HAIRS & TRY AGAIN >

Cross-hair intersection does not lie on waveform.

OPTION

03 - TRUNCATE FRONT

GENERAL DESCRIPTION:

This option allows the user to permanently eliminate all waveform points to the left of the cross-hair intersection point. The waveform being truncated is that which is currently displayed under the "SINGLE" module.

DIALOGUE:

System:

<POSITION X-HAIRS WITH CONTROL DIALS 1 & 2 THEN CARRIAGE RETURN>

User:

Aligns cross-hairs to desired truncation point.

Intersection of cross-hairs indicates desired truncation point.

System:

<TRUNCATION COMPLETE >

ERROR MESSAGES:

1. <BYPASS ERROR >

Error in aligning file to waveform start.

2. <I/O ERROR >

A fatal system error in transferring data from disk to core or vice versa.

3. <FILING SYSTEM ERROR>

A fatal system error caused by the failure of the filing system to find the specified file.

4. <ILLEGAL TRUNCATION POINT>

Cross-hair intersection does not lie on the waveform.

OPTION

04 - INSERT APR SEG MK

GENERAL DESCRIPTION:

This option allows the user to erase a begin or end marker or both and then insert a begin or end marker or both. Segment markers may be specified by either typing in the desired marker time or by using the cross-hairs. Segment markers are permanently stored in the waveform header. "Insert Apriori Segment Marker" assumes the user is currently displaying a waveform under the "SINGLE" Display Module.

DIALOGUE:

System:

<Ø = ERASE BEGIN, 1 = ERASE END, CR = BOTH >

User:

Enter Ø, 1, or CR.

System:

<INSERT BEGIN/END MARKER, Ø = X-HAIR, CR = SPECIFY >

User:

Enter Ø or CR

if Ø, user aligns X-hairs then CR.

if CR, user types in specific time.

System:

<NEW HEADER INFO INSERTED>

ERROR MESSAGES:

1. <FILING SYSTEM ERROR - DATA SET SELECTED?>

No current data set in system.

11-04-01

2. <ILLEGAL END MARKER >

User has specified an end marker that occurs earlier in time than the begin marker.

3. <DISPLAY NOT IN TIME MODE >

Current display is in frequency domain.

WVFEDT

08-00-12

OPTION

05 - SPECIFY TEMP SYMB

GENERAL DESCRIPTION:

This option allows the user to specify a temporary symbol, consisting of one character, to be stored in the current waveform header.

DIALOGUE:

System:

< ENTER TEMPORARY SYMBOL >

User:

Enters one keyboard character and CR. Any VG keyboard character is legal.

System:

< HEADER INFO INSERTED >

ERROR MESSAGES:

1. < FILING SYSTEM ERROR - DATA SET SELECTED >

No current data set has been specified.

11-05-01

WVFEDT

08-00-12

OPTION

06 - SEGMENT WAVEFORM

GENERAL DESCRIPTION:

This option allows the user to specify, using the X-hairs, a point on the current waveform at which the wave will be divided into two parts. All points to the right of the intersection point will become the current wave with the present ID. All points to the left will become a new wave, under the current node, with a user specified ID.

DIALOGUE:

System:

< ALIGN X-HAIRS, USING DIALS 1 & 2, THEN CR >

User:

Aligns X-hair. Intersection point indicates point of desired segmentation

System:

< ENTER NEW ID >

User:

User may enter a new waveform ID which will be associated with all points to the left on the intersection point. A valid ID=x, where $0 \leq x \leq 2^{32}-1$.

System:

< WAVEFORM ANALYSIS IN PROGRESS >

< WAVEFORM SEGMENTATION IN PROGRESS >

< NEW WAVE CREATED, DESIGNATED WAVE TRUNCATION NOW IN PROGRESS >

11-06-01

ERROR MESSAGES:

1. < BYPASS ERROR >

Error in aligning file to waveform start.

2. < I/O ERROR >

A fatal system error in transferring data from disk to core
or vice versa.

3. < FILING SYSTEM ERROR >

A fatal system error caused by the failure of the filing
system to find the specified file.

4. < ILLEGAL TRUNCATION POINT >

Cross-Hair intersection does not lie on the waveform.

WVFEDT

08-00-12

OPTION

07 - DELETE WAVEFORM

GENERAL DESCRIPTION:

This option allows the user to eliminate forever the waveform currently displayed under the "SINGLE" module.

DIALOGUE:

System:

< DELETION COMPLETE >

ERROR MESSAGES:

1. < FILING SYSTEM ERROR >

Current data set not specified.

2. < USE DELETE NODE >

There exists only one waveform in the current node.

WVFEDT

08-00-12

OPTION

09 - MODIFY TIME REFERENCE

GENERAL DESCRIPTION:

This option allows the user, by direct specification or using the cross-hairs, to specify a point in the current waveform, at which the time will be made zero.

DIALOGUE:

System:

<CR = SPECIFY TIME, -Ø = X-HAIRS >

User:

Enter CR, or Ø

if CR - specify time,

if Ø - align X-hairs, then CR

The time entered, or intersection specified will become time zero in that waveform.

ERROR MESSAGES:

1. <DISPLAY NOT IN TIME MODE >

Current waveform is in the frequency domain.

11-09-01

SECTION 12

MULTIPLE WAVE INITIALIZING FRAME

Frame Name: MINIT

Call Sequence: 08-01

MULTIPLE WAVE INITIALIZATION FRAME

GENERAL DESCRIPTION:

There are three ways to proceed once a user enters this frame. If he wishes to display multiple waveforms from one node only, his most likely recourse is to select either MULTI PAGE INIT (01) or MULTI SCROLL INIT (02). In these options he has to enter either a tree and node name or a carriage return for each if he wishes to re-init them, the number of waveforms to be displayed, and a starting sequence number (i.e., the ordinal number of the waveform in the node he desires to be in the first position (top) of the screen). Each time he then hits the DISPLAY NEXT (00) light button in the Multiple Display Frame, a new sequence of waveforms from the entered node will be displayed. For each position on the Vector General the next waveform displayed will be either (1) the succeeding one in the node for MULTI SCROLL INIT (02) or (2) the nth (the number of positions displayed) one following it for MULTI PAGE INIT (01).

If a user, however, wishes to display waveforms from more than one node, from the same tree or from different trees, he must invoke SELECT DATA SETS (00). In this option he must first enter the number of positions to be displayed, then a tree name and a node name for each position. Carriage returns make this process easy sometimes. Each time the system asks for a tree or a node name, the user may hit a carriage return which automatically enters the last tree or node name typed in respectively. Also, if SELECT DATA SETS (00) is invoked and it is the multiple-init option last invoked without leaving the MINIT frame the user may re-init all the data sets by entering "Y" in response to the re-init question.

This frame brings in the Multiple Waveform Display Frame in which the user invokes either DISPLAY NEXT (00) or SCROLL (07) to begin the display.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - SELECT DATA SETS	12-00-01
01 - MULTI PAGE INIT	12-01-01
02 - MULTI SCROLL INIT	12-02-01
03 - (blank)	
04 - "	
05 - "	
06 - "	
07 - "	
08 - "	
09 - "	
10 - "	
11 - "	
12 - "	
13 - "	
14 - RET TO WPS FRAME	7-1
15 - RET TO INIT FRM	2-1

MINIT

08-01

OPTION

00 - SELECT DATA SETS

GENERAL DESCRIPTION:

After invoking this option the user specifies the number (between 2 and 10) of positions and the data set in each position to be displayed in the Multiple Waveform Display Frame.

DIALOGUE:

System:

< # WAVES = >

User:

Enters N $2 \leq N \leq 10$ N is the number of positions to appear
on the VG. Each position has one waveform.

System:

< ENTER TREE NAME >

User:

This question is asked as many times as the # WAVES which the
user just entered.

For the first position on the top of the screen of the VG the
user must enter a tree name---up to six characters.

On any succeeding position the user may enter a tree name or
hit a carriage return which automatically enters the tree name
entered on the preceding line (which may also have been entered
by a CR).

12-00-01

System:

< ENTER NODE NAME >

User:

In the same manner as he entered tree names, the user enters a node name (up to five characters) or a carriage return, depending on which position it is for.

System:

< REINIT PREVIOUS FILES? Y=YES >

This request only appears if two conditions are met:

- (1) The last multiple wave initialization option chosen was SELECT DATA SETS (00).
- (2) The user has not left the MINIT or MWVDSP frames.

User:

Enters "Y" to re-initialize at once all the data sets which were previously selected.

ERROR MESSAGES:

< ERROR IN ATTEMPTING TO OPEN DESIGNATED FILE >

This error follows the entering of a node name. The node entered could not be found in the filing system. This error ends the inputting of tree and node names which the user may yet have to enter and brings in the multiple wave display frame if any files have been already opened. The files that were opened successfully may then be displayed.

< GO TO SELECT DATA SET IN SINGLE >

This message occurs only when the user enters a "1" for the number of waves.

NEXT FRAME:

MWVDSP (Multiple-waveform Display Frame)

MINIT

08-01

OPTION

01 - MULTI PAGE INIT

GENERAL DESCRIPTION:

The data sets in this option are automatically initialized after the tree name, node name, number of waves, and starting sequence number are entered. The top position on the Vector General screen will contain the waveform equal to the starting sequence number into the node. The positions following, from top down, will each contain the waveform succeeding the one above it. The next time the DISPLAY NEXT (00) option is invoked in the MWVDSP frame, the top position will contain the waveform succeeding the one on the bottom of the last display. Thus, sequences of waveforms are displayed, for instance, 1-5, 6-10, 11-15, etc.

DIALOGUE:

System:

< ENTER TREE NAME >

User:

The response is up to six characters entered followed by CR.

If possible, a carriage return response will duplicate the last tree name entered via a multi-page or multi-scroll option. A carriage return response is possible if (1) multi-page or multi-scroll has been selected previously and (2) the user has not exited from the MINIT or MWVDSP frames since the last selection.

System:

< ENTER NODE NAME >

12-01-01

User:

The response is up to five characters entered followed by CR.

As in entering a carriage return for the tree name, a carriage return may be entered to duplicate the last node entered. The same conditions apply.

System:

< # WAVES = >

User:

Enters N $2 \leq N \leq 10$ N is the number of positions to appear on the VG. Each position has one waveform.

System:

<ENTER START SEQUENCE NUMBER>

User:

Enters N $1 \leq N \leq X$ X= # waves in the node

ERROR MESSAGES:

<ERROR IN ATTEMPTING TO OPEN DESIGNATED FILE >

User will have to re-select MULTI PAGE INIT (01) because the node or tree could not be found in the filing system.

NEXT FRAME:

MWVDSP

12-01-02

MINIT

08-01

OPTION

02 - MULTI SCROLL INIT

GENERAL DESCRIPTION:

This option is identical to MULTI PAGE INIT (01) except that the sequences of waveforms displayed are, for example, 1-5, 2-6, 3-7, to give a scrolling effect.

DIALOGUE:

System:

<ENTER TREE NAME >

User:

Enters up to six characters followed by CR. As in MULTI-PAGE (01), a carriage return may duplicate the last tree name entered via multi-page or multi-scroll.

System:

<ENTER NODE NAME >

User:

Enters up to five characters followed by CR or a carriage return, if possible, for duplication.

System:

<# WAVES = >

User:

Enters N $2 \leq N \leq 10$ N is the number of position also.

System:

<ENTER START SEQUENCE NUMBER >

12-02-01

User:

Enters N $1 \leq N \leq X$ X = # waves in the node.

ERROR MESSAGES:

<ERROR IN ATTEMPTING TO OPEN DESIGNATED FILE >

User will have to re-select MULTI SCRL INIT (02) because the node
or tree could not be found in the filing system.

NEXT FRAME:

MWVDSP

SECTION 13

MULTIPLE WAVE DISPLAY FRAME

Frame Name: MWVDSF

Call Sequence: 08-01-14

MWVDSP

08-01-00

01

02

MULTIPLE WAVEFORM DISPLAY FRAME

GENERAL DESCRIPTION:

MWVDSP is the frame which contains the light-buttons which display, on the Vector General, waveforms from the data set(s) chosen by the user in the MINIT frame. See MINIT frame for a more complete description. MWVDSP cannot be reached without going through MINIT.

SPECIAL DISPLAY SYMBOLS:

The following symbols are located at the end of a waveform in the middle of its display band on the Vector General:

(1) → indicates "waveform incomplete"

The absence of an arrow indicates "waveform complete."

(2)] indicates "end of data set"

The SINGLE frame "END INPUT FILE REACHED".

WAVEFORM RETRIEVALS IN PROGRESS

This message appears only if one or more of the waveforms is long (over 65K) and is displayed in "FIT" mode (see HORZ SCALING (07)).

OPTIONS

DESCRIPTION ON PAGE

00 - DISPLAY NEXT	13-00-01
01 - DISP NEXT (PICK)	13-01-01
02 - CONTINUE WAVE	13-02-01
03 - CONTINUE (PICK)	13-03-01
04 - DISPLAY SAME	13-04-01
05 - SCROLL	13-05-01
06 - VERTICAL SCALING	13-06-01
07 - HORZ SCALING	13-07-01
08 - SEQUENCE SELECT N	13-08-01
09 - SELECT START VAL	13-09-01
10 - (blank)	
11 - TRANSLATION	13-11-01
12 - (blank)	
13 - RET TO M-W INIT	12-1
14 - RET TO WPS FRAME	7-1
15 - HARDCOPY	

MWVDSF

08-01-00

01

02

00 - DISPLAY NEXT

GENERAL DESCRIPTION:

This option displays either starting waveforms from the data sets initialized in the preceding frame (MINIT) upon the first call, or **sequential waveforms** upon subsequent calls. A starting waveform is either the first waveform of a data set or the one equal to the starting sequence number set either by SEQUENCE SELECTION (05) in MWVDSF, or by MULTI PAGE INIT (01) or MULTI SCROLL INIT (02) in MINIT. A sequential waveform is either a following waveform or the one equal to the sequence number set by any of the same three options.

DIALOGUE:

None

ERROR MESSAGES

<FILE NOT OPENED >

The node or tree could not be opened in the MINIT frame.

<SYSTEM ERROR >

Usually means a file structure incompatible with WPS has been found.

<TIME (OR FREQ) SELECTED BEYOND RANGE OF WAVEFORM >

User must correct this situation by invoking SFLECT START VAL (09) and entering a new or default value.

13-00-01

MWVDSF

08-01-00

01

02

OPTION

01 - DISP NEXT (PICK)

GENERAL DESCRIPTION:

This option allows a user to select whichever positions he wants activated by the DISPLAY NEXT (00) option. Only in those positions selected by this option will the next waveform in the data set be displayed upon invoking DISPLAY NEXT (00).

DIALOGUE:

System:

< ENTER POSITION NUMBERS (A=ALL CR=EXIT) >

User:

A string of numbers corresponding to positions (1 = top of screen) and separated by commas may be entered. The numbers do not have to be entered in numerical order.

ERROR MESSAGES

None

13-01-01

MWVDSF

08-01-00

01

02

OPTION

02 - CONTINUE WAVE

GENERAL DESCRIPTION:

This option will display a new page from waveforms which are incomplete after the preceding display. Waveforms which are already complete are not modified.

The new pages may begin with selected starting values which have not yet been displayed. If a selected starting value has already appeared within the waveform band it was selected for, DISPLAY SAME (04) will display the new value.

DIALOGUE:

see <DISPLAY NEXT (00) >

ERROR MESSAGES

<HIT "DISPLAY NEXT" FIRST >

<CONTINUE WAVE> cannot display the first page of a waveform.

Others - see DISPLAY NEXT (00)

MWVDSP

08-01-00

01

02

OPTION

03 - CONTINUE (PICK)

GENERAL DESCRIPTION:

This option allows a user to select whichever positions he wants activated by the CONTINUE WAVE (02) option. Only in those positions selected by this option will the next page of the waveforms be displayed upon invoking CONTINUE WAVE (02).

DIALOGUE:

System:

<ENTER POSITION NUMBERS TO BE CONTINUED A=ALL CR=EXIT >

User:

A string of numbers corresponding to positions (1=top of screen) and separated by commas may be entered. The numbers do not have to be in numerical order.

ERROR MESSAGES

None

13-03-01

MMVDSP

08-01-00

01

02

OPTION

04 - DISPLAY SAME

GENERAL DESCRIPTION:

This option re-displays all waveforms either from the same time or frequency as they were displayed or else from a new selected starting value.

DIALOGUE:

See DISPLAY NEXT (00)

ERROR MESSAGES:

< HIT "DISPLAY NEXT" FIRST >

If a user has just selected a new data set by returning to the MINIT frame, and an old data set is still being displayed, then this option will blank out the screen and display this message on the bottom when mistakenly invoked.

Other messages - see DISPLAY NEXT (00)

MWVDSP

08-01-00

01

02

OPTION

05 - SCROLL

GENERAL DESCRIPTION:

There are two different ways to scroll a data set to its end: "across" and "along". The "along" method is the automatic invoking of DISPLAY NEXT's and CONTINUE WAVES' the currently displayed waveform on until the "]" appears on all positions, or until the scrolling is stopped by the user's selecting a light-button. "Across" means that for each position only one page will be displayed from each waveform until the data set is exhausted. If a waveform is already being displayed, the "across scroll" starts from the next waveform at the same time or frequency that the displayed waveform starts. Thus, all the pages from a particular data set (on one position) will start at the same time or frequency. As with the "along" scrolling, the user may stop the display at any time by selecting a light button.

An automatic hard copy function is available for each type of scrolling.

The user also selects the amount of viewing time for each display (in seconds).

DIALOGUE:

System:

<ANY POSITIONS TO SCROLL "ACROSS" INSTEAD OF "ALONG"? Y=YES >

If user enters "Y", then:

<ENTER POSITIONS TO SCROLL ACROSS. A=ALL >

User:

Enters position numbers (1= top of screen) separated by commas, or else "A".

System:

<TYPE # OF SECONDS TO DELAY >

13-05-01

User:

Enters an integer or a carriage return default (=1)

System:

< AUTO-HARDCOPY? Y=YES >

User enters "Y" to hardcopy each display

ERROR MESSAGES:

See DISPLAY NEXT (00)

AD-A032 305

PATTERN ANALYSIS AND RECOGNITION CORP ROME N Y F/G 9/2
THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM --ETC(U)
SEP 76 P K SANYAL, C BERSTER, T MCGIBBON F30602-72-C-0193
PAR-76-6 RADC-TR-76-224-VOL-2 NL

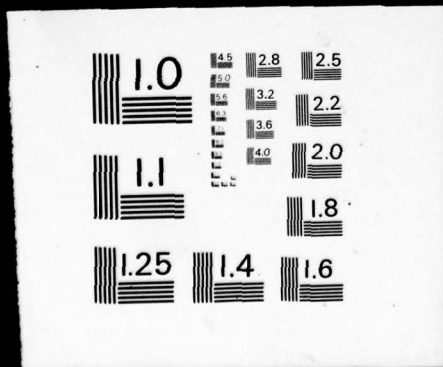
UNCLASSIFIED

3 OF 7
ADA032305



3 OF 7

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OPTION

06 - VERTICAL SCALING

GENERAL DESCRIPTION:

In this option the user chooses one of four vertical scaling modes for each position on the VG. He also may enter grid level values which will appear over one or more positions.

The four vertical scaling modes follow with their option number (see Figure 13-1 on page 13-06-06):

0. PAGE GLOBAL

SCALE TO MAXIMUM ON PAGE

Explanation: The minimum and maximum values found over all the positions displayed on the VG are used as lower and upper bounds for whichever positions have 0 for vertical scaling mode.

1. LOCAL SCALING (DEFAULT)

SCALE TO MAX ON LINE

Explanation: The minimum and maximum value displayed on one position are used for that position as lower and upper bounds.

2. EXPLICIT

USER SPECIFIED MIN/MAX

Explanation: A user may select different minimums and maximums as lower and upper bounds for the positions he wants to be scaled in this mode.

3. WAVEFORM GLOBL

SCALE TO MAXIMUM IN WAVEFORM

Explanation: For any position to be scaled in this mode, the maximum and minimum value found in the displayed (or to be displayed) waveform's header are used as the upper and lower bound for that position.

Grid level values may also be selected in this option. Up to twenty values may be entered. These same twenty values will appear as horizontal lines across the positions the user enters to receive grid levels.

DIALOGUE:

System:

<ENTER POSITION NUMBERS TO BE SCALED A=ALL CR=EXIT >

User:

Enters integers corresponding to positions displayed or to be displayed on the VG (1 = top of screen). The numbers must be separated by commas. "A" will scale all positions.

System:

<ENTER CORRESPONDING OPTION NUMBER(S) >

User:

As an example, the positions the user wants scaled are 1, 3, 5, 7, 9 which he entered for the previous question. Now, say he wants positions 1, 5 and 7 to be in EXPLICIT mode and 3 to 9 to be in PAGE GLOBL mode. His response will

be 2, 0, 2, 2, 0. If he wants all 1, 3, 5, 7, 9 positions to be in PAGE GLOBL mode he need only enter 0. And, if 1, 3, and 5 are to be PAGE GLOBL and 7 and 9 to be EXPLICIT he need only enter 0, 0, 0, 2. The last number entered (in this case, 2) is duplicated out to the number of position numbers entered.

If only one position number was entered for the previous question the system's request would be:

< ENTER OPTION NUMBER >

and the user may enter only one number.

If a "2" (EXPLICIT) mode was entered as an option number, the system will ask:

<FOR POSITIONS __, __, __, ... ENTER CORRESPONDING VALUE(S)
OF MAX AND MIN SEPARATE EACH NUMBER BY COMMA >

The above blanks are filled in by the system with the position numbers the user indicated he wants to be in EXPLICIT mode.

User:

The response is in groups of maximums and minimums, each group corresponding to the position number asked in the query. All groups as well as max's and min's are separated by commas. The last group is duplicated out to the number of positions asked for. The user could plan ahead if he wants

several positions to receive the same min and max by
entering these positions last in response to the first
question (ENTER POSITION NUMBERS TO BE SCALED...)

System:

If grid level values do not exist in the system:

<GRID LINES? Y=YES >

If grid level values do exist:

<Y=NEW GRID LINES NEEDED S=SAME AS SHOWN >

User:

Enters "Y" to either, or "S" to the second, or CR to both
meaning NO. If neither Y nor S are entered, all existing
grid lines are erased in the case of the second message.

If "Y" is entered:

System:

< ENTER POS. NUMBERS A=ALL S=SAME CR=EXIT >

User:

Enters string of numbers separated by commas, or A, or S
to duplicate the position numbers entered in response to
the first question this light-button asked.

System:

< ENTER LEVELS AT WHICH GRID LINES DESIRED, SEPARATE
EACH BY COMMA >

User:

Up to twenty numbers may be entered, each number lies
between - 32768 and 32767.

ERROR MESSAGES:

<TOO MANY ENTERED >

This appears if more options are entered than positions requested, or if more than twenty grid level values are entered, or if too many groups of maximums and minimums are entered.

<OPTION SELECTED DOES NOT EXIST >

A number other than 0, 1, 2, or 3 was entered.

<INPUT ERROR >

The maximums and minimums were not entered correctly.

VERTICAL SCALE OPTIONS

- 0 - PAGE GLOBAL
Scale to maximum on page
- 1 - LOCAL SCALING (DEFAULT)
Scale to max on line
- 2 - EXPLICIT
User specified min/max
- 3 - WAVEFORM GLOBL
Scale to maximum in waveform

Figure 13-1 Vertical Scale Options in the Multiple
Waveform Display Frame Displayed in the G.P. Region

MWVDSP

08-01-00

01

02

OPTION

07 - HORZ SCALING

GENERAL DESCRIPTION:

In this option the user chooses one of four horizontal scaling modes for each position on the VG. He also may enter grid marks for one or more positions.

The four horizontal scaling modes follow with their option numbers (see Figure 13-2 on page 13-07-07):

0. ACCEPT DEFAULT VALUE

Explanation: Default values are 512 points/line,
point sequence (P) = 1.

1. N UNITS PER LINE

Explanation: The time or frequency range to appear
on one line is entered.

2. M POINTS PER LINE

PLOT EVERY PTH POINT

Explanation: This is the "EXPLICIT" mode wherein the
user enters points per line and point sequence values.

3. FIT WAVEFORM TO LINE

Explanation: The waveform is scaled to fit in its
position band on the VG (one line).

Grid marks appear as vertical tick marks beneath the displayed waveforms. The user may select one of two modes for any position or positions desired, as follows:

1. N UNITS PER MARK

Explanation: The user must enter time or frequency values which will be the value between successive grid marks.

2. N MARKS PER LINE

Explanation: The user enters the number of tick marks to appear beneath the waveform - if 100 points per line are entered explicitly, 100 marks per line will match up one to one on the VG.

DIALOGUE:

System:

< ENTER POSITION NUMBERS TO BE SCALED A=ALL CR=EXIT >

User:

Even though the data sets selected in the MINIT frame may not have been displayed as yet, the user should at least keep in mind the number of positions he requested (# WAVES). Position numbers start at the top (1).

System:

< ENTER CORRESPONDING OPTION NUMBER(S).

SEPARATE EACH BY COMMA >

User:

Enters at least one option number (0, 1, 2, or 3). The last number entered in the string is duplicated out to the number of positions requested. (See detailed explanation of the process in VERTICAL SCALING (06).

If option #1 was selected for any position:

System:

< FOR POSITIONS __, __, __, ... ENTER CORRESPONDING

VALUE(S) OF SECS OR HZ PER LINE. USE LABEL >

User:

Enters decimal or integer numbers. Up to 10 digits on the left and nine digits to the right may be entered. Negative values not allowed. The user should use the label list displayed on the VG because one label must follow each value. The last value displayed will be duplicated out if fewer values than positions called for are entered.

If option #2 was selected for any position:

System:

< FOR POSITIONS __, __, __, ... ENTER CORRESPONDING

POINTS PER LINE >

User:

Enters an integer value between 1 and 3414. Any value over 1707 is not recommended, however, for the position will mostly be all white. (Also, if many values over 512 are entered, the display may be abbreviated, mainly in the information displayed beneath the waveforms, due to an overflow in the display buffer.) The last value will be repeated if necessary. Also:

System:

< FOR POSITIONS __, __, __,... ENTER CORRESPONDING
VALUES OF P >

User:

Enters point sequences, positive integers, separated by
commas. The last value will be repeated if necessary.
For all option numbers:

System:

< GRID MARKS WANTED Y=YES >

or < Y=NEW GRID MARKS NEEDED S=SAME >

The second message is given if grid marks have already been
selected and the user wishes to preserve them. If the user
enters "Y", the grid mark options are displayed and the user
is asked: (See Figure 13-3 on page 13-07-08.)

< ENTER POSITION NUMBERS A=ALL S=SAME CR=EXIT >

User:

"S" is entered to keep the same position numbers entered
before in response to the option's initial query. If position
numbers or "A" is entered:

< ENTER CORRESPONDING OPTION NUMBER(S).
SEPARATE EACH BY COMMA >

User:

Enters at least one "1", or "2", the rest being duplicated
if necessary. If a "1" has been entered:

< FOR POSITIONS __, __, __,... ENTER CORRESPONDING VALUE(S)
OF SECS OR HZ PER MARK. USE LABEL >

User:

The label list will not be displayed at this time, but the user should keep in mind they are M, K, S or H, m, μ , m. (μ is entered by SPEC M). The last value entered will be repeated if necessary to the number of positions requesting grid mark option #1.

If a "2" has been entered:

< FOR POSITIONS __, __, __,... ENTER CORRESPONDING NO.(S) OF
GRID MARKS >

User:

The range for the number of grid marks is 1 to 1707.

The last number entered will be repeated if necessary.

ERROR MESSAGES

< TOO MANY ENTERED >

This message pertains to any "corresponding values" which exceed the positions they are for.

< INPUT ERROR >

This message is for a faulty input value for seconds or Hertz per line or mark; also if a 0 has been entered for points per line or P or marks per line.

<OPTION SELECTED DOES NOT EXIST >

An option number other than 0, 1, 2, or 3; or a grid mark option other than 1 or 2 has been entered.

13-07-06

HORIZONTAL SCALE OPTIONS

- 0 - ACCEPT DEFAULT VALUES
- 1 - N UNITS PER LINE
 LABEL LIST:
 - M = MEGA(SECS OR HZ)
 - K = KILO(SECS OR HZ)
 - S OR H = SECONDS OR HERTZ
 - M = MILLI(SECS OR HZ)
 - μ = MICRO(SECS OR HZ)
 - n = NANO(SECS OR HZ)
- 2 - M POINTS PER LINE (512)
 PLOT EVERY PTH POINT
- 3 - FIT WAVEFORM TO LINE

Figure 13-2 Horizontal Scale Options in the Multiple Waveform Display Frame Displayed in the G.P. Region

GRID MARK OPTIONS

- 1 - N UNITS PER MARK
- 2 - N MARKS PER LINE

Figure 13-3 Grid Mark Options for the Horizontal
Scale Option in the Multiple Waveform Display Frame
Displayed in the G. P. Region

MWVDSP

08-01-00

01

02

OPTION

08 - SEQUENCE SELECTION

GENERAL DESCRIPTION:

This option allows a user to enter starting sequence numbers and nth-waveform values. Starting sequence numbers are for the initial display of the data sets chosen in the frame MINIT. For each position, the starting sequence number minus one waveforms are skipped over in the node and the next one displayed. From then on, succeeding displays will be of waveforms existing in increments of nth-waveform values away from the initially displayed one.

DIALOGUE:

System:

<ENTER START SEQUENCE POSITION NUMBER(S). A=ALL CR=NONE >

User:

Enters the position numbers (1 = top of VG) which will receive starting sequence values. If starting sequence values are not desired, the user should enter carriage return - this will display the message for positions requiring nth-waveform values.

If position numbers or "A" is entered:

ENTER CORRESPONDING START SEQUENCE NUMBER(S)

If only one position number is entered:

ENTER START SEQUENCE NUMBER

User:

The numbers entered must be separated by commas and correspond to the positions in the same manner: position input is 9, 2, 1, 8

13-08-01

and start sequence input is 5, 20, 3, 70; thus the fifth waveform into the node in the ninth position, the twentieth into the node in the second position, the third into the node in the first position, and the seventieth into the node in the eighth position will be displayed either by DISPLAY NEXT (00) or SCROLL (05).

The last number entered (70 in example) will be used for the rest of the positions if the number of sequence values entered is less than the number of positions (not done in example).

System:

< ENTER POSITION NUMBERS TO RECEIVE NTH WAVE VALUES.

A=ALL S=SAME CR=EXIT >

User:

The choice "S" means the same position numbers entered that received starting sequence values.

If position number "A" or "S" is entered:

ENTER CORRESPONDING NTH WAVE VALUE(S)

If only one position number is entered:

ENTER N

User:

Enters positive integers separated by commas or at least one integer since the last or lone number is repeated automatically but invisibly to the user.

ERROR MESSAGES:

< TOO MANY ENTERED >

The number of sequence values exceeds the number of positions
they are for.

< INPUT ERROR >

A character other than a number or comma has been entered.

OPTION

09 - SELECT START VAL

GENERAL DESCRIPTION:

In this option the user may select a starting value for any position either by positioning the cross hairs over a point displayed or by entering a value from the keyboard. Invoking DISPLAY SAME (04) will display those positions receiving start values from the selected start value, as well as those positions that didn't. Any other waveform to be displayed by a DISPLAY NEXT (00) will also be displayed starting from the selected start value. The start value will remain until the data sets are re-initialized in the MINIT frame.

DIALOGUE

If waveforms are displayed from the selected data set:

<CROSS HAIRS NEEDED? Y=YES >

User:

Enters Y to get control of cross hairs. Positions the horizontal cross hair anywhere in the desired position band and the vertical cross hair over the point whose value is desired. Carriage return then enters the value and a new message is displayed:

< REPEAT CROSS HAIRS? Y=YES >

User:

Enters Y to repeat the cross-hair input. CR will display a new message; which is the same message that would have been displayed had there been no waveforms up originally:

< ENTER POSITION NO.'S THAT WILL RECEIVE KEYBOARD INPUT
VALUES. A=ALL CR=EXIT >

User:

Enters position numbers (top position = #1) separated by commas
or A for all positions.

System:

< ENTER CORRESPONDING START VALUE(S).

EACH VALUE MUST INCLUDE A 1-LETTER LABEL. CR=DEFAULT >
or if only one position:

< ENTER START VALUE. INCLUDE LABEL CR=DEFAULT >

User:

Enters decimal or integer values or both. Each value must
be separated by a comma. The decimal value may have up to
10 digits on the left (and a sign) and up to 9 digits on
the right of the decimal point. The labels and their powers
of ten are: M(6), K(3), S or H(01), m(-3), μ (-6), n(-9).
 μ is entered by SPEC M. The last number is repeated invisibly if
the number of values does not equal the number of positions.

CR will set default values on all the positions selected.
Default values are the first points of all waveforms to be
displayed.

ERROR MESSAGES:

<INPUT ERROR>

A bad character was entered in the keyboard string.

<TOO MANY ENTERED>

The number of start values exceeds the number of
selected positions.

<SYSTEM ERROR>

A file structure incompatible with WPS has been encountered.

<INPUT VALUE TOO HIGH>

<INPUT VALUE TOO LOW >

Each start value should lie between

-2147483848 and 2147483847

<INVISIBLE INPUT ERROR >

The horizontal cross hair lies in a blank position.

11 - TRANSLATION

GENERAL DESCRIPTION:

This option allows the user to specify number of the waveform to be translated. The x,y coordinates of that wave are then shifted on the VG to correspond to the analog output of control dials 1 and 2.

DIALOGUE:

System:

<ENTER POSITION TO BE TRANSLATED >

The topmost waveform is defined as number one, the next one under that is number two, etc.

User:

The number of the waveform to be translated is entered followed by a carriage return.

System:

<CR TO EXIT >

The routine is hanging in a wait-loop, allowing the user to manipulate control dials 1 & 2, thereby changing the x & y waveform coordinates. When a CR is entered the specified wave will return to its rightful position.

ERROR MESSAGES:

< POSITION CANNOT BE MOVED >

This is a system error, and is due to the failure of the multi-display module to insert the proper code in the VG buffer.

SECTION 14

WAVE TO WAVE TRANSFORMATION FRAME

Frame Name: WAVE

Call Sequence: 08-02

FUNCT

08-02

WAVE TO WAVE TRANSFORMATION FRAME

GENERAL DESCRIPTION:

The first three options deliver other frames containing specific wave-to-wave transform options.

OPTIONS

DESCRIPTION ON PAGE

00	SPECTRAL ANALYSIS	15-1
01	ALGEB/CALCULUS	16-1
02	ARITHMETIC	17-1
03	(blank)	
04	"	
05	"	
06	"	
07	"	
08	"	
09	"	
10	LIST TREES	4-00-01
11	SELECT DATA SET	8-13-01
12	DRAW TREES	2-05-01
13	RET TO WPS FRAME	7-1
14	RETURN INIT FRAME	2-1
15	HARDCOPY	

FUNCT

08-02

OPTION

01- SPECTRAL ANALYSIS

GENERAL DESCRIPTION:

This function in the Wave to Wave Transformations Frame introduces the Spectral Analysis Frame. It also creates the core-image file of the module parameters (with default values) if it does not exist. If this file does exist then a question will be asked regarding the status of the parameter file.

DIALOGUE:

System:

Delivers the description of spectral parameters to the general purpose region of the display screen (Figure 14-1 on page 14-01-02).

If core-image file does not exist then the system creates it with default values and proceeds to final system action.

If file exists then

< TYPE "Y" TO RESTORE DEFAULT PARAMETERS >

User:

- (a) "Y" or "y" to initialize parameters
- (b) anything else to preserve the current values

System:

Delivers Spectral Analysis Frame "SPCTRM"

< END TRANSACTION >

14-01-01

THE DEFAULT OR INITIAL WPS PARAMETERS USED IN THIS MODULE ARE THE FOLLOWING:

INPUT IS CURRENT DATA SET (ASSUMES REAL)

OUTPUT IS POWER SPECTRUM

WAVE SEQUENCE * IS 1

Ø IMPLIES CURRENT WAVEFORM ONLY

POINT SEQUENCE * IS 1

WINDOW: 1ST M POINTS OF EACH WAVEFORM (M=1024)

WEIGHTING FUNCTION: HAMMING FOR INVERSE FILTER. NONE FOR THE REST...

LET L BE NUMBER OF POINTS IN WAVEFORM.

IF $L < M$, THEN LAST M-L POINTS FILLED WITH AVERAGE VALUE.

IF $L > M$, THEN LAST L-M POINTS IGNORED.

OUTPUT TREE TEXT IS DUPLICATED FROM INPUT TREE

D.C. LEVEL ON INPUT SIGNAL IS REMOVED

YOU MAY OVERRIDE ANY OF THESE PARAMETERS BY SELECTING OPTIONS ON LEFT.

FIGURE 14-1 DEFAULT PARAMETERS FOR SPECTRAL/MODULE DISPLAYED IN THE G.P. REGION

ERROR MESSAGES:

(A) < DISK READ FAULT >

- (1) If this was the first entry to the Spectral Module on the system disk then there is a possibility that the system directory is filled to capacity or a read or write disk command failed.
- (2) If this was not the first entry to the Spectral frame then the diagnosis is a disk read failure in an attempt to retrieve the core-image file.
A fatal error.

SECTION 15

SPECTRAL ANALYSIS FRAME

Frame Name: SPCTRM

Call Sequence: 08-02-01

SPECTRAL ANALYSIS MODULE

GENERAL DESCRIPTION:

The user has the ability to specify real or complex temporal inputs and transform them into (and out of) the spectral domain. The basis of all transforms in this module is the floating point Fast Fourier Transform (FFT).

An input to the module may be an entire data set or a sub-set, one waveform, or a segment of a waveform. The waveform currently displayed in the Single-Display Module may be designated as an input. Furthermore, a wide range of options exist to manipulate input windows. Among these are modifications of time or frequency resolution, sliding window processing, application of weighting functions, and window fill selections. The opportunity to remove the average value (DC term) is given prior to any transform execution as well.

The user may select any combination of transforms. FFT may be output as components in the complex plane or as modulus/angle; FFT inverse and power spectrum are of course also available. For the analysis of convolved signals, the cepstrum, complex cepstrum, and its associated inverse are included. Incorporated especially for the speech researcher, besides the above mentioned tools, are the various inverse filtering techniques consisting of the extraction of (1) inverse filter coefficients, (2) reflection coefficients, and (3) formant spectrum.

Options in the "SPCTRM" frame designated 00 through 06 are all parameter gathering functions with 01 serving as a readout utility for the current values of those parameters. The execution of any of these options should not be considered an irreversible action in that only upon selection of the "EXECUTE" function (key 08) are the invested parameter values committed.

All transformations are (input) tree → (output) tree, each output requiring a new tree, and each transformation making use of the tree-structure preserving I/O of WPS.

<u>MENU</u>	<u>DESCRIPTION ON PAGE</u>
00 - INPUT DATA SET	15-00-01
01 - OUTPUTS	15-01-01
02 - WAVE SEQUENCE #	15-02-01
03 - POINT SEQUENCE #	15-03-01
04 - WINDOW OPTIONS	15-04-01
05 - WEIGHTING FUNCTIONS	15-05-01
06 - WINDOW FILL	15-06-01
07 - CHECK SPC PARAMS	15-07-01
08 - EXECUTE	15-08-01
09 - ***	
10 - LIST TREES	4-00-01
11 - WAVE/WAVE TRANS	14-1
12 - SINGLE WAVE/EDIT	8-1
13 - MULTIPLE WAVE DISPLAY	12-1
14 - RETURN TO WPS FRAME	7-1
15 - HARDCOPY	

SPCTRM

08-02-01

OPTION

00 - INPUT DATA SET

GENERAL DESCRIPTION:

User identifies an input data set, real or complex; an entire tree; sub-tree; or a single node (file) to the spectral analysis module.

DIALOGUE:

S1 System:

< ENTER 0 IF INPUT IS REAL, 1 IF COMPLEX >

User:

0 or 1 entered

<CR> alone implies input is real

System:

Lists all waveform trees

< ENTER 6 CHAR TREE NAME FOR REAL INPUT >

User:

6 characters or less are entered

<CR> alone implies current data tree is identified

System:

Draws the specified tree

< ENTER 5 CHAR NODE NAME FOR REAL INPUT >

User:

5 characters or less are entered. Senior node name is a valid entry.

<CR> alone implies current node is identified

15-00-01

IF the answer to question S1 was not 0, then dialogue continues...otherwise end transactions.

System:

Lists all waveform trees

< ENTER 6 CHARACTER TREE NAME FOR IMAGINARY INPUT >

User:

6 characters or less are entered

<CR> alone implies pick the current tree

System:

Draws the specified tree

< ENTER 5 CHARACTER NODE NAME FOR IMAGINARY INPUT >

User:

Enters 5 characters or less

<CR> alone implies the current node

ERROR MESSAGES:

< NON-EXISTENT DATA SET >

Data set explicitly specified could not be found in the data directory. Reselect data set.

< CURRENT DATA SET NOT SPECIFIED >

Data set implicitly specified (<CR> alone) was never selected, i.e., there is no current data set. Select data set.

< DISK READ FAULT >

Attempt to retrieve core-image file failed. Probably fatal.

< DISK WRITE FAULT >

Attempt to update core-image file failed. Probably fatal.

OPTION

01 - OUTPUTS

GENERAL DESCRIPTION:

User identifies all desired transformations (outputs) to be executed.

DIALOGUE:

System:

Delivers the outputs sub-menu (See Figure 15-1 on page 15-01-02).

< ENTER DESIRED OPTION NUMBERS, SEPARATE EACH BY COMMA >

User:

(a) Enters a list of numbers in the form, for example, 4, 7, 0, 2.

(b) <CR> alone implies power spectrum is the only output.

S1 System:

If answer above was (b) then end dialogue...otherwise

dialogue continues (according to above example)

< ENTER 6 CHAR TREE NAME FOR REAL DATA OUTPUT IN OPTION "0" >

User:

Enters 6 characters or less

System:

If the option number corresponds to a transform which has a complex output then the following question is submitted. ("0" → FFT transforms to the complex plane).

< ENTER 6 CHAR TREE NAME FOR IMAGINARY DATA OUTPUT IN OPTION "0" >

OUTPUT OPTIONS

- 0 FFT
- 1 FFT MAGNITUDE
- 2 FFT PHASE
- 3 LOG FFT MAGNITUDE
- 4 INVERSE FFT
- 5 POWER
- 6 LOG POWER
- 7 CEPSTRUM
- 8 COMPLEX CEPSTRUM
- 9
- 10 CONTINUOUS FFT PHASE
- 11 INVERSE CEPSTRUM
- 12 INVERSE FILTER COEFFICIENTS
- 13 REFLECTION COEFFICIENTS
- 14 FORMANT SPECTRUM

FIGURE 15-1 THE OUTPUT OPTIONS OF THE SPECTRAL MODULE DISPLAYED
 IN THE G.P. REGION

User:

Enters 6 characters or less.

System:

Repeats from S1 until output selections are exhausted. From the example, the order would be 0, 2, 4, 7, end transactions.

If any of the output options included either 12, 13, or 14 the following dialogue follows after the loop.

< ENTER DESIRED NUMBER OF COEFFICIENTS TO BE GENERATED PER FRAME (1,30)>

User:

Enters number between 1 and 30

<CR> implies previous value. Initial value is 10.

System:

< ENTER PRE-EMPHASIS CONSTANT (RANGE IS 0 TO 100, 1 IMPLIES ADAPTIVE)>

User:

Enters number between 0 and 100.

<CR> implies previous value. Initial value is 0.

ERROR MESSAGES:

< DISK READ FAULT >

Attempt to retrieve core-image file failed. Probably fatal.

15-01-03

< DISK WRITE FAULT >

Attempt to update core-image file failed. Probably fatal.

15-01-04

SPCTRM

08-02-01

OPTION

02 - WAVE SEQUENCE #

GENERAL DESCRIPTION:

The opportunity to process every other wave or every third wave (rather than every wave), etc., is given to the user. A special request case identifies the waveform currently displayed in the Single Frame for spectral analysis processing. Range is (0, 255).

DIALOGUE:

System:

< ENTER WAVE SEQUENCE # (CR) -- > CURRENT WAVE ONLY

User:

- (a) Number between 1 and 255 is entered.
- (b) 0 or <CR> is entered implying that the input is 1 wave only, the wave last displayed in the Single-Display Module.

In the case of response (b) the output trees created will all be with single low-node, all having the designated tree names but with that low node name being "WAVE". e.g.

phase



The file name containing the data is listed in the directory as "pWAVE".

15-02-01

ERROR MESSAGES:

< DISK READ FAULT >

Attempt to retrieve core-image file failed.

< DISK WRITE FAULT >

Attempt to update core-image file failed.

SPCTRM

08-02-01

OPTION

03 - POINT SEQUENCE #

GENERAL DESCRIPTION:

The user may wish to process, for example, every other point or every third point of his input waveforms. Thus a modification of time resolution or frequency resolution is effected through this option. The outputs will, of course, reflect this change in the form of a modified sampling rate. If p is the point sequence number then the output sampling rate (ESR) is the original (SR) divided by p , i.e.

$$ESR = SR/p$$

DIALOGUE:

System:

< ENTER POINT SEQUENCE # >

User:

(a) Number is entered ranging from 1 to 65535

(b) <CR> implies number requested is 1

ERROR MESSAGES:

< DISK READ FAULT >

Attempt to retrieve core-image file failed.

< DISK WRITE FAULT >

Attempt to update core-image file failed.

15-03-01

OPTION

04 - WINDOW OPTIONS

GENERAL DESCRIPTION:

The user is given 3 modes of preparing his input windows. In total, he may select 2 starting point for each waveform, a window size for processing, number of windows to prepare per waveform, and number of points to slide in the case of a sliding window option. Also, in the case of a polymorphic operation, i.e. the multiple window process, an ID generation scheme will be requested of the user.

DIALOGUE:

S1 System:

Delivers window option sub-menu (Figure 15-2 on page 15-04-02)

< ENTER WINDOW OPTION >

User:

(a) enters 0 or <CR>

(b) enters 1

Refer to Figure 15-2

(c) enters 2

(d) enters 3

WINDOW OPTIONS

0 FIRST M POINTS FROM SELECTED START

M= ? (8 < M < 1024)

START AT ? (< CR > INDICATES THE BEGINNING OF THE WAVE)

1 FIRST M POINTS FROM MARKED PORTION

M= ? (8 < M < 1024)

2 SLIDING WINDOW FROM SELECTED START

WINDOW SIZE= ? (8 < M < 1024)

OF WINDOWS= ? (< CR > INDICATES AS MANY AS POSSIBLE)

WINDOW SLIDE= ? (< CR > INDICATES RETRIEVE ADJACENT WINDOWS)

START AT ? (< CR > INDICATES THE BEGINNING OF THE WAVE)

3 SLIDING WINDOW FROM MARKED PORTION

WINDOW SIZE= ? (8 < M < 1024)

OF WINDOWS= ? (< CR > INDICATES AS MANY AS POSSIBLE)

WINDOW SLIDE= ? (< CR > INDICATES RETRIEVE ADJACENT WINDOWS)

FIGURE 15-2 THE WINDOW OPTIONS OF THE SPECTRAL MODULE DISPLAYED
IN THE G.P. REGION

CASE 1: User's response to question S1 was (a)

GENERAL DESCRIPTION:

Specify window size and starting point through time or freq. reference.

S2 System:

< WINDOW SIZE (M) = >

User:

(a) User enters a window size: range is (8,1024)

(b) <CR> indicates that window size is 1024

System:

IF number entered is not an exact power of 2, then
with "Q" being the next (higher) power of 2 with respect
to that number, the following ensues.

S3 System:

< DO YOU ACCEPT "Q" (Y,N) >

User:

(a) Enters "N" or "n" to reject

(b) Enters anything else; i.e., CR, to accept

S4 System:

IF response to S3 is (a) then the dialogue resorts
to S2. IF response to S3 is (b) then continue.

S5 System:

< ENTER START UNIT >

User:

- (b) CR indicates the beginning of the wave
- (2) double precision floating point format followed by time or frequency units symbol is entered, for example, "1.24S" specifies a starting point of 1.24 seconds for each wave inputted. (See Option 10 "SELECT START TIME" in SINGLE frame).

end transactions

CASE II: User's response to S1 was (b)

GENERAL DESCRIPTION:

One window is to be processed for each waveform. Window size is specified and the event given by the segment markers only is taken for processing.

DIALOGUE:

See sequence S2, S3, S4

CASE III: User's response to question S1 was (c)

GENERAL DESCRIPTION:

A sliding window process is being requested. A window size and number of windows is requested. Also the number of points to slide for the next window is asked. Since more than one waveform will be created from just one input waveform, a waveform ID generation scheme must be designated by the user. Lastly, a starting point for each input waveform is requested through a time or frequency reference.

DIALOGUE:

See sequence S2, S3, S4

Follow by:

System:

< # OF WINDOWS = >

User:

- (a) Number between 1 and 65535 is entered.
- (b) 0 or <CR> indicates as many as possible.

S7 System:

If the response to S6 was 1 then skip to S9

< WINDOW SLIDE = >

User:

- (a) Enters between 1 and 32767.
- (b) <CR> indicates that the slide will be equal to the window size,
i.e., adjacent windows (no overlap) will be processed.

S8 System:

< SPECIFY ID GENERATION FIELD >

User:

- (a) Entry is in the form "p,q" where both p and q must be in the range (1, 10). For example, "3,7" would mean that, of the 10 digit ID, the 3rd to the 7th digit may be changed to generate new ID's. Again, 5,5 would mean that only the 5th digit will be altered. In general the maximum number of IDs generated for "p,q" is $10^{*(p-q+1)}$.
- (b) <CR> indicates that "p,q" is "1,5" i.e. default values for p,q are 1,5.

S9 System:

See dialogue for question S5.

CASE IV: User's response to S1 was (d)

GENERAL DESCRIPTION:

Same as for Case III except that where the available data points are specified by a start time or frequency within the input waveform for Case III, the available data points are implicitly taken as the marked portion of the wave in this case. Refer to segment markers for explanation of "marked" portion.

DIALOGUE:

See Case III dialogue minus last question.

ERROR MESSAGES:

< DISK READ FAULT>

Attempt to retrieve core-image file failed.

< DISK WRITE FAULT >

Attempt to update core-image file failed.

15-04-07

SPCTRM

08-02-01

OPTION

05 - WEIGHTING FUNCTIONS

GENERAL DESCRIPTION:

A weighting function specified by the user is impressed on every window processed. The functions cover a wide range to suit any application. The menu includes rectangular (no weighting), Hanning, Hamming, and Blackman weighting. (See Figure 15-3 on page 15-05-02).

DIALOGUE:

System:

Delivers weighting functions sub-menu

< ENTER CORRESPONDING WEIGHTING FUNCTION CODE >

User:

(a) Enters number between 1 and 3

(b) 0 or <CR> indicates rectangular (no weighting)

ERROR MESSAGES:

< DISK READ FAULT >

Attempt to retrieve core-image file failed.

< DISK WRITE FAULT >

Attempt to update core-image file failed.

WINDOW WEIGHTING FUNCTIONS

```
*****
0  /RECTANGULAR    (DEFAULT)/
*****
1  /HANNING/
*****
2  /HAMMING/
*****
3  /BLACKMAN/
*****
```

FIGURE 15-3 WINDOW WEIGHTING FUNCTIONS OF THE SPECTRAL MODULE
DISPLAYED IN THE G.P. REGION

OPTION

06 - WINDOW FILL

GENERAL DESCRIPTION:

When the window size exceeds the number of points available, the user has the option of designating a "fill" value for the excess points. He may choose the average value or some fixed value. Furthermore, he may wish to fill not at the end alone but to distribute the excess on both sides (front and back) of the window. Default is average value, back fill.

DIALOGUE:

S1 SYSTEM:

Delivers the window fill sub-menu

< ENTER WINDOW OPTION >

User:

(a) 0 → fill at the end

(b) 1 → fill at both ends

(c) <CR> → same as (a)

S2 System:

<DC FILL? (Y, N) >

User:

(a) Enters "Y" or "y" to fill with average value.

(b) Anything else for some fixed value.

System:

If response to S2 was (a) then end dialogue; otherwise,

< ENTER NUMBER TO BE FILLED IN >

User:

- (a) Number between -32768 and 32767 is entered. This number is taken relative to the scale factor of the waveform.
- (b) <CR> implies the number entered is the previous value; initial value is 0.

ERROR MESSAGES

< DISK READ FAULT >

Attempt to retrieve core-image file failed.

< DISK WRITE FAULT >

Attempt to update core-image file failed.

SPCTRM

08-02-01

OPTION: [not yet implemented]

07 - CHECK SPECTRAL PARAMETERS

GENERAL DESCRIPTION:

The user may inspect the parameters chosen thus far. A list is formatted to the line printer.

DIALOGUE:

System:

Parameters are sent to the line printer.

ERROR MESSAGES:

< DISK READ FAULT >

Core-image file (parameter file) could not be retrieved from
the disk.

< ATTEND LINE-PRINTER >

Line-printer is not in an "accept" state.

15-07-01

SPCTRM

08-02-01

OPTION

08 - EXECUTE

GENERAL DESCRIPTION:

Initiate execution based on the existing parameters. Output trees corresponding to each transformation requested are created. Tree text is requested for each output tree designated. With the selection of this option, the current parameter values are now committed.

DIALOGUE:

System:

If current wave only was designated as input then the user
may or may not see the message

< DUPLICATING CURRENT WAVE >

depending on the size of the waveform.

If the only output requested was power spectrum the following
ensues.

< ENTER 6 CHAR TREE NAME FOR POWER SPECTRUM OUTPUT >

User:

Enters 6 characters or less.

S1 System:

(in all cases)

< ENTER 60 CHARACTERS OR LESS OF TEXT FOR OUTPUT TREE "ABCDEF" >

User:

(a) Enters 60 characters or less of text for tree designated
"ABCDEF".

(b) <CR> indicates copy text from input tree.

15-08-01

System:

Repeat S1 until number of trees exhausted; follow by

< REMOVE DC COMPONENT? (Y, N) >

User:

(a) "Y" or "y" indicates removal of average value.

(b) Anything else (e.g. CR) indicates no removal.

System:

If any of the transforms requested involves the log function

then the following request is made:

< ENTER A NON-NEGATIVE ϵ FOR LOG ARGUMENT >

User:

(a) Enters a double precision floating point value greater than 0.

(b) < CR > implies previously entered value is satisfactory. Initial default value is 1E-38. The ϵ is added to any zero value in the argument of the log since otherwise the attempt to compute log of zero would cause problems.

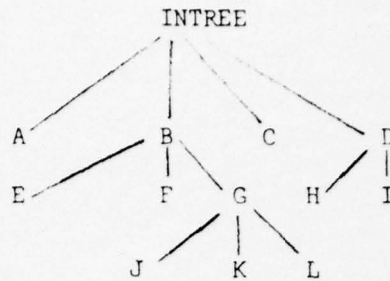
System:

Draws the input tree

< COMPUTATION IN PROGRESS: WORKING ON FILE "SOMNOD" >

is transmitted for every low node (file) the system encounters on input.

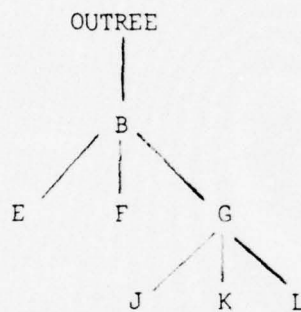
For example, given the input as: (tree) "INTREE"
(node) "B"



The following files will be processed:

"E", "F", "J", "K", "L"

Furthermore, all output trees will take the form



ERROR MESSAGES

< DISK READ FAULT >

Attempt to retrieve core-image file failed.

< CORE-IMAGE FILE DISRUPTED >

This is either a program or hardware fault. Re-enter the Spectral Module and type "y" to initialize the file for best chance of recovery. (Refer to option <08-02-01>)

< DATA SET NOT SELECTED >

At this time no current data set has been designated.
Select data set in this frame (see <08-02-01-00>) or select data set outside this frame.

< PROGRAM FAULT >

Fatal error...either a program inconsistency or illegal format for the input waveform.

< TREE NAME ERROR OR DISK FAULT >

Possibly a bad input tree or output tree designated already exists.

Check output tree names designated against tree listing or check the input tree.

< ERROR...INCONSISTENT INPUT DATA >

The tree containing the imaginary coefficients of the specified complex input could not be retrieved.

Check both trees (real and imaginary parts), compare all node names other than the senior node; they should be the same.

< PROGRAM/DATA/DISK ERROR >

- (1) Program inconsistency,
report error to system overseer.
- (2) Data error suggests that the format of the input waveform being retrieved is wrong.
- (3) Disk read fault is a hardware failure in reading the disk.

< ERROR...INCONSISTENT DATA >

This error indicates a mismatch of the real and imaginary data sets. Possible mismatch in number of waveforms per file or dimensionality per waveform. Another possibility is that waveform IDs do not match.

< ERR: INPUT TO INV CEP EXCEEDS CALL RANGE >

In attempting to take the inverse cepstrum (of the complex cepstrum) difficulty was encountered with the exponential function. In recovering the power coefficient, $r^2 + \epsilon$, the argument $\text{EXP}(\text{LOG}(r^2 + \epsilon))$ would have caused an overflow.

Check that the input is indeed the output of a complex cepstrum transformation. Check that the header information of the input has not been modified since that ϵ is written there.

< WRITE ERROR >

An attempt to write an output waveform failed; possibly a write disk fault or no free sectors on the disk.

SECTION 16

ALGEBRAIC/CALCULUS FRAME

Frame Name: ALGCAL

Call Sequence: 08-02-02

ALGEBRAIC CALCULUS FRAME

GENERAL DESCRIPTION:

This frame allows the user to perform isomorphic one-to-one tree transformations.

INITIAL DIALOGUE:

The initial dialogue in every algebraic calculus overlay is handled by the algebraic calculus executive. It is as follows:

System:

< ACCEPT CURRENT PARAMETERS: A=ACCEPT, CR=REJECT >

User:

Current paraments are node, tree, and data type. This question only appears if these "SINGLE" parameters have been previously set.

Reply - A, CR or CR.

System:

If CR then:

< ENTER INPUT DATA TYPE >

User:

Enter 63 then CR

System:

< ENTER INPUT TREE NAME >

User:

Enter tree name then "CR".

System:

< ENTER INPUT NODE NAME >

User:

Enter node name without tree symbol and "CR"

System:

If user accepted the current parameters the above three queries are bypassed.

< ENTER OUTPUT DATA TYPE >

User:

Enter 63 and "CR".

System:

< ENTER OUTPUT TREE NAME >

User:

Enter from one to six characters and "CR".

System:

< ENTER UP TO 60 CHARACTERS OF TREE TEXT >

User:

Enter desired text and "CR".

System:

< CURRENT WAVE OR NODE(S)? CR=NODES, W=WAVE >

If current parameters were accepted, the system wants to know if the user desires the transformation on the entire node or the current waveform being displayed.

User:

"CR" or "W", "CR"

System:

< EVERY Nth WAVE >

User:

Enter "N", "CR"

The system will transform every N^{th} wave starting with "N".

System:

< EVERY P^{th} POINT >

The system will transform every P^{th} point, starting with "P".

User:

Enter "P" and "CR".

This ends the common dialogue. The specific overlay dialogue follows.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - NORMALIZE	[Not Implemented]
01 - SMOOTHING	[Not Implemented]
02 - ARITHMETIC	ARITH FRAME
03 - DEMODULATION	[Not Implemented]
04 - RECTIFICATION	16-04-01
05 - INDEFINITE INTEGRAL	[Not Implemented]
06 - DIFFERENCE	[Not Implemented]
07 - EXPONENTIAL	[Not Implemented]
08 - LOG	[Not Implemented]
09 - <u>+</u> LIMITER	16-09-01
10 - LIST TREES	2-04-01
11 - SELECT DATA SET	8-13-01
12 - DRAW TREE	2-05-01
13 - RETURN TO WAVE TO WAVE	14-1
14 - RETURN TO WPS FRAME	7-1
15 - (blank)	

ALGCAL

08-02-02

OPTION

04 - WAVEFORM RECTIFICATION

GENERAL DESCRIPTION:

This routine performs half or full wave rectification of a given data set under process control from the algebraic calculus executive.

DIALOGUE:

System:

< H=HALF WAVE, CR=FULL WAVE >

User:

"H", "CR" or "CR"

System:

< RECTIFICATION IN PROGRESS >

< RECTIFICATION COMPLETE >

ERROR MESSAGES:

< FILING SYSTEM ERROR >

Fatal retrieve system error - check input parameters.

ALGCAL

08-02-02

OPTION

09 - + LIMITR

GENERAL DESCRIPTION:

This routine transforms a given data set to reflect a user-specified minimum and maximum, i.e. the waveform is clipped at the specified levels.

DIALOGUE:

System:

< ENTER DESIRED UPPER LIMIT - DEFAULT= \emptyset >

User:

Enter $x \rightarrow 0 \leq x \leq (2^{16}-1)$ and "CR".

System:

< ENTER DESIRED LOWER LIMIT - DEFAULT= \emptyset >

User:

Enter $y \rightarrow -2^{16} \leq y \leq 0$

System:

< USER SPECIFIED MIN-MAX XFORM IN PROGRESS >

< TRANSFORMATION COMPLETE >

ERROR MESSAGES:

< ASCII TO FLOATING CONVERSION ERROR >

Fatal conversion error, check input limits.

< FILING SYSTEM ERROR >

Fatal retrieve system error - Check input parameters

16-09-01

SECTION 17

ARITHMETIC FRAME

Frame Name: ARITHC

Call Sequence: 08-02-02-02

ARITHC

08-02-02-02

ARITHMETIC FRAME

GENERAL DESCRIPTION:

This frame allows the user to perform arithmetic transformations on a given data set. These operations can be polymorphic.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - ADD/SUB	[Not Implemented]
01 - MULT/DIV	[Not Implemented]
02 - $Y = Ax + B$	[Not Implemented]
03 - $Y = A(X - \text{WAVE})$	[Not Implemented]
04 - EVERY PTH PT	[Not Implemented]
05 - SHIFT	[Not Implemented]
06 - LATERAL GRIDS	[Not Implemented]
07 - DC REMOVAL	[Not Implemented]
08 - (blank)	
09 - "	
10 - SPEC PROTOTYPE	[Not Implemented]
11 - LIST TREES	2-04-01
12 - DRAW TREES	2-05-01
13 - SEL DATA SET	8-13-01
14 - RET TO AL/CAL	16-1
15 - RET TO W/W TRANS	14-1

SECTION 18

SEGMENTATION FRAME

Frame Name: SEGMNT

Call Sequence: 08-03

SEGMENTATION FRAME

GENERAL DESCRIPTION:

This frame will automatically segment waveforms of a waveform tree by first creating a marker tree (a set of begin and end marks), and then, using the marker tree, create a segmented waveform tree. The tree/node structure of the marker tree must match the tree/node structure of the original waveform tree in order to segment. The marker tree has data type 90 and is a permanent file structure that can receive a new tree name or maintain the original treename with a different data type (90). The segmented tree is a permanent file structure and must receive a new name; however, it maintains the same data type and tree/node structure. Upon entering segmentation, the following information appears on the VG screen to aid the user. (see Figure 18-1 on page 18-3)

In addition to the above, the options will appear to the left on the VG screen.

Figure 18-2 on page 18-4, shows the relationship of the parameters needed in order to do automatic segmentation.

The quantities that are pertinent to a segmentation routine and supplied by the user are defined below:

Window Size (W_b, W_e): The window size over which a functional is computed. Different criteria may be used to set the begin and end marks and therefore, the window sizes for the begin mark and the end mark can be different. W_b and W_e are the window sizes for the begin and end markers.

Threshold (T_b, T_e): The functional computed over a window is checked against a threshold value to check if the criterion is satisfied. The threshold for the begin marker and end marker can be different and are labeled T_b and T_e respectively.

Window Slide (S_b, S_e):

Until a criterion is satisfied, the window is moved, the functional recomputed and checked against the threshold, and the process repeated over and over. The slide for the begin marker window is S_b and that for the end marker window is S_e .

Lockout Time (T_{lo}): After a begin marker has been located, a certain amount of the following portion of the waveform is skipped before the computation for the end marker is begun.

This period is called the "lockout time". The purpose of the lockout time is either to allow at least a certain length for the segmented waveform or to reduce computation since it may be known that the end marker cannot lie within a certain distance from the begin marker.

Max Time (T_{\max}): T_{\max} is the maximum allowable length of a segment. If the specified end marker criterion is unable to place an end marker within T_{\max} of the begin marker, then an end marker is placed at a distance T_{\max} from the begin marker.

Default Time (T_{def}):

When a default time is specified, the end marker is placed T_{def} distance away from the begin marker and no criterion is needed for this marker.

NOTE Whenever the system dialogue asks the user for a parameter or method the text will have a set of parentheses at the end inclosing the current value/method pertaining to that question. A carriage return will maintain value in parentheses.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - BEGIN MARK	18-00-01
01 - END MARK	18-01-01
02 - THRES OPT BEGIN	18-02-01
03 - THRES OPT END	18-03-01
04 - CREATE MARKERS	18-04-01
05 - SEGMNT ASSIGNED	18-05-01
06 - SEGMNT APRIORI	18-06-01
07 - CREATE PROTOTYPE	18-07-01
08 - EDIT	8-1
09 - SINGLE WAVE	8-1
10 - LIST TREES	2-04-01
11 - SELECT DATA SET	8-13-01
12 - DRAW TREE	2-05-01
13 - (blank)	11-1
14 - RET TO WPS FRAME	7-1
15 - RET TO INIT FRAME	2-1

BEFORE SEGMENTING DATA, YOU MUST CHOOSE PARAMETERS FOR BEGIN MARKS AND END MARKS, THEN SELECT CREATE MARKERS.

CREATE MARKS WILL FORM A NEW TREE TYPE CONSISTING OF SEGMENT MARKERS

SEGMENT ASSIGNED WILL USE THIS NEW TREE DATA TYPE TO SEGMENT DATA AND MAINTAIN SAME TREE STRUCTURE AS INITIAL TREE WITH SAME NODE NAMES: HOWEVER, YOU WILL BE ASKED TO TYPE A NEW NAME FOR SEGMENTED DATA.

SEGMENT APRIORI WILL SEGMENT DATA ACCORDING TO MANUALLY SET MARKERS PLACED UNDER EDIT.

CREATE PROTOTYPE WILL CREATE A PROTOTYPE WAVEFORM AS MARKED IN EDIT.

APRIORI AND PROTOTYPE WILL ASK FOR A NEW TREE NAME.

BEGIN OR END MARK WILL SEQUENCE YOU THROUGH A QUESTION AND ANSWER PERIOD TO CHOOSE PARAMETERS FOR CREATING MARKERS. BOTH MUST BE CALLED PRIOR TO CREATING MARKERS. YOU WILL BE ASKED A CRITERION YOU WANT TO USE.

THRES OPT BEGIN OR END WILL ALLOW YOU TO SELECTIVELY CHANGE ANY OF THE BEGIN OR END PARAMETERS OR METHOD.

FIGURE 18-1

INITIAL INFORMATION FOR SEGMENTATION FRAME DISPLAYED IN THE G.P. REGION

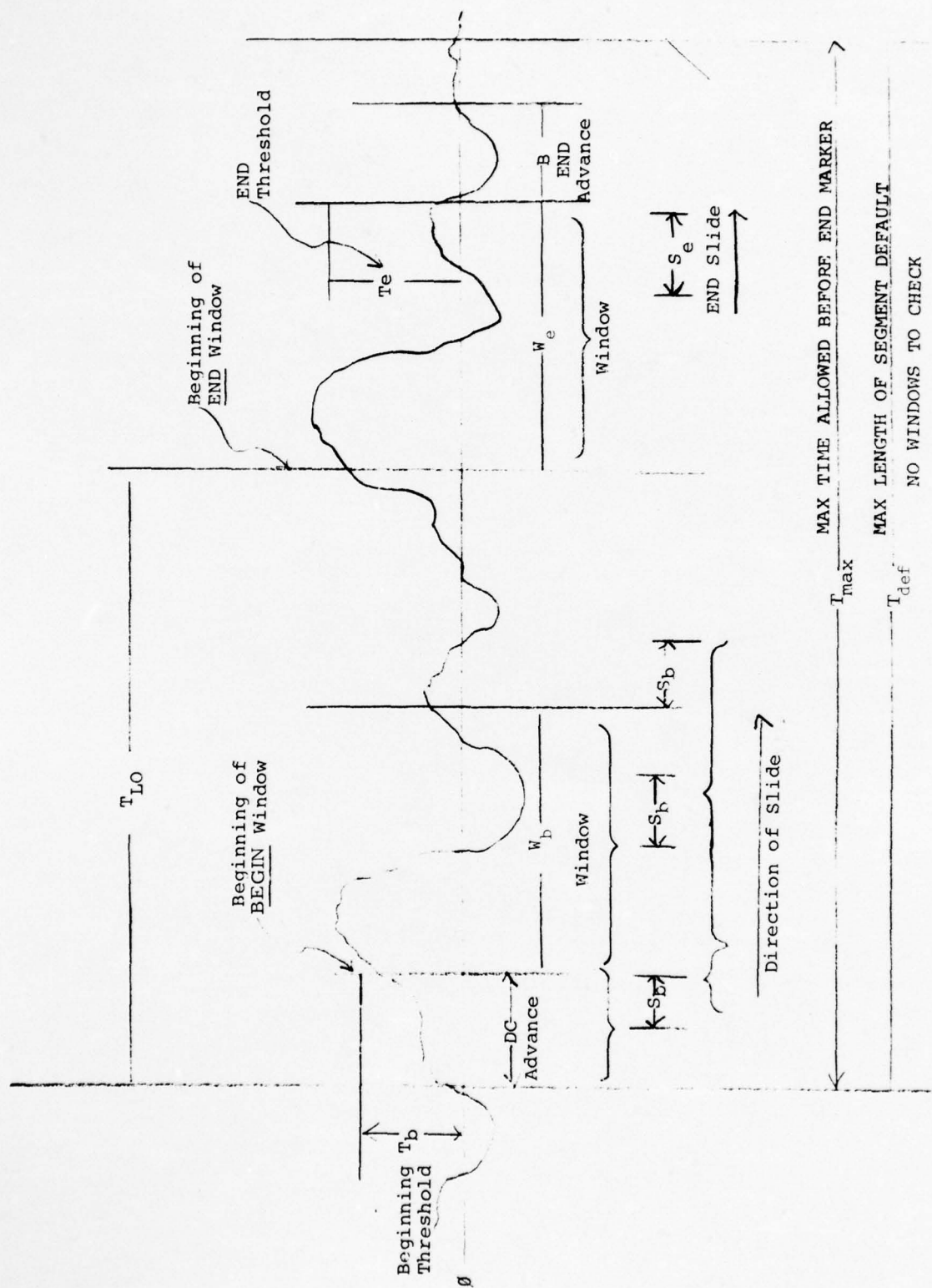


Figure 18-2
BEGIN and END Parameters

SEGMENT

08-03

OPTION

00 - BEGIN MARK

GENERAL DESCRIPTION:

This option will sequence user through a question and answer period to choose parameters for creating begin marks (see Figure 18-1). Also user must specify what criteria he wants to use. Begin mark will cause the menu/ instruction (shown in Figure 18-3) to appear on VG.

DIALOGUE:

System:

< BEGIN CRITERIA NUMBER () = >

User:

Enter a number that corresponds to a criterion as shown in menu.

NOTE If criteria= 1A 1 or 2 (Cross Correlation or Convolution)

go to S1. Otherwise go to S2.

S1 System:

< PROTOTYPE SIZE () = >

User:

Enters size (up to 1024 points)

System:

< ENTER 6 CHAR PROTOTYPE NAME () >

User:

User enters name

System:

< BEGIN WINDOW SIZE () = >

User:

User enters size

18-00-01

MENU FOR BEGIN MARK

ENTER PARAMETERS/CRITERIA AS ASKED

* PARAMETER

- 1 CRITERIA (1) CROSS CORRELATION
 - (2) CONVOLUTION
 - (3) RISE IN TIME WINDOW
 - (4) FALL IN TIME WINDOW
 - (5) AMPLITUDE LEVEL
 - (6) AVERAGE VALUE IN TIME
 - (7) AVERAGE POWER IN TIME
 - (8) AVER A-C PWR IN TIME
 - (9) ZERO CROSSING
- 2 WIDTH OF SLIDING WINDOW
- 3 BEGIN THRESHOLD
- 4 THRESHOLD LOGIC ..LT, LE, EQ, GE, GT, NE
- 5 ADVANCE AHEAD OF WINDOW
- 6 WINDOW SLIDE ADVANCE
- 7 NEW PROTOTYPE FOR CROSS CORR. OR COMU.

FIGURE 18-3

MENU FOR BEGIN MARK FOR SEGMENTATION DISPLAYED IN THE G.P. REGION

System:

< BEGIN THRESHOLD FOR METHOD () () = >

User:

User enters threshold for the method specified

System:

< SELECT THRES. LOGIC LT, LE, EQ, GE, GT, NE () >

User:

User enters logic (upper or lower case)

System:

< ADVANCE AHEAD OF WINDOW () = >

User:

User enters advance

System:

< WINDOW SLIDE ADVANCE FOR BEGIN () = >

User:

User enters slide advance

System:

< ENTER THE NUMBER OF PARAMETER TO BE CHANGED >

User:

User enters a number on the left portion of the menu that corresponds to any criteria/parameter he wants to change. The appropriate question will then be asked by the system. Typing a carriage return will exit user from begin mark option.

System:

If end mark hasn't been selected!

< END PARAMETERS NOT SET/SELECT END MARK >

User:

Next Select "END MARK" Option

ERROR MESSAGES

< PROGRAM OR DISK ERROR >

Caused if parameters can't be stored or retrieved from

Disk File Storage.

SEGMNT

08-03

OPTION

01 - END MARK

GENERAL DESCRIPTION:

This option will sequence the user through a question and answer period to choose parameters for creating end markers (see Figure 18-1). Also user must specify what criteria he wants to use. End mark will cause the menu/instructions (shown in Figure 18-4) to appear on VG.

DIALOGUE:

System:

< END CRITERIA NUMBER () = >

User:

Enter a number that corresponds to criteria as shown in menu.

NOTE If criteria=1 or 2 (Cross Correlation or Convolution) go to S1, otherwise go to S2.

S1 System:

< PROTOTYPE SIZE () = >

User:

Enters size (up to 1024 points)

System:

< ENTER 6 CHAR PROTOTYPE NAME () >

User:

Enter 6 char. name

NOTE If criteria=10 (end x pts after begin) go to S2, otherwise go to S3.

S2 System:

< ENTER MAXIMUM LENGTH OF SEGMENT () = >

18-01-01

MENU FOR END MARK

ENTER PARAMETERS/CRITERIA AS ASKED

* PARAMETER

- 1 CRITERIA (1) CROSS CORRELATION
- (2) CONVOLUTION
- (3) RISE IN TIME WINDOW
- (4) FALL IN TIME WINDOW
- (5) AMPLITUDE LEVEL
- (6) AVERAGE VALUE IN TIME
- (7) AVERAGE POWER IN TIME
- (8) AVER A-C PWR IN TIME
- (9) ZERO CROSSING
- ... (10) END X PTS AFTER BEGIN
- 2 WIDTH OF SLIDING WINDOW
- 3 END THRESHOLD
- 4 THRESHOLD LOGIC ..LT, LE, EQ, GE, GT, NE
- 5 ADVANCE AFTER WINDOW
- 6 WINDOW SLIDE ADVANCE
- 7 NEW PROTOTYPE FOR CROSS CORR. OR CONV.
- 8 LOCKOUT AFTER TURN ON POINT
- 9 MAXIMUM LENGTH OF SEGMENT
- 10 ... SEGMENT LENGTH IF NO END CRITERIA

FIGURE 18-4 MENU FOR END MARK FOR SEGMENTATION DISPLAYED IN THE G.P. REGION

User:

Enter maximum length

S3 System:

< END WINDOW SIZE () = >

User:

Enter size

System:

< BEGIN THRESHOLD FOR METHOD () () = >

User:

Enter threshold for the method specified.

System:

< SELECT THRES LOGIC LT, LE, EQ, GE, GT, NE () >

User:

Enter Logic (upper or lower case)

System:

< ADVANCE AFTER WINDOW () = >

User:

Enter Advance

System:

< WINDOW SLIDE ADVANCE FOR END () = >

User:

Enter slide advance

System:

< ENTER THE NUMBER OF PARAMETER TO BE CHANGED >

User:

User enters a number on the left portion of the menu that corresponds to any change of criteria/parameters he wants to make. The appropriate question will then be asked by the system. Typing a carriage return will exit user from begin mark option.

System:

If begin mark hasn't been selected!

< BEGIN PARAMETERS NOT SET/SELECT BEGIN MARK >

User:

Next select begin mark option

ERROR MESSAGES:

< PROGRAM OR DISK ERROR >

Caused if parameters can't be stored or retrieved from disk file storage.

MENU FOR BEGIN MARK

TO CHANGE ANY PARAMETER ENTER * ON LEFT

* PARAMETER

1 CRITERIA (1) CROSS CORRELATION
 (2) CONVOLUTION
 (3) RISE IN TIME WINDOW
 (4) FALL IN TIME WINDOW
 (5) AMPLITUDE LEVEL
 (6) AVERAGE VALUE IN TIME
 (7) AVERAGE POWER IN TIME
 (8) AVER A-C PWR IN TIME
 (9) ZERO CROSSING

2 WIDTH OF SLIDING WINDOW

3 BEGIN THRESHOLD

4 THRESHOLD LOGIC ..LT, LE, EQ, GE, GT, NE

5 ADVANCE AHEAD OF WINDOW

6 WINDOW SLIDE ADVANCE

7 NEW PROTOTYPE FOR CROSS CORR. OR CONV.

CR TO EXIT

FIGURE 18-5 DISPLAY IN THE G.P. REGION ASSOCIATED WITH OPTION 2
 OF THE SEGMENTATION FRAME

SEGMNT

08-03

02 - THRES OPT BEGIN

GENERAL DESCRIPTION:

This option allows the user to selectively change any of the begin parameters or method in order to correct or optimize segmentation. The user selects the change to be made by typing the change number on the left column corresponding to criteria or parameter, shown in Figure 18-5, then answering system questions.

DIALOGUE:

System:

< ENTER THE NUMBER OF PARAMETER TO BE CHANGED >

User:

User enters a number on the left portion of the menu that corresponds to any criteria/parameter he wants to change. The appropriate question will then be asked by the system. Typing a carriage return will exit user from begin mark option.

System:

If end mark hasn't been selected!

< END PARAMETERS NOT SET/SELECT END MARK >

User:

Next select end mark option

ERROR MESSAGES:

< PROGRAM OR DISK ERROR >

Caused if parameters can't be stored or retrieved from
Disk File Storage.

18-02-01

SEGMNT

08-03

03 - THRES OPT END

GENERAL DESCRIPTION:

This option allows the user to selectively change any of the end parameters or method in order to correct or optimize segmentation. The user selects change to be made by typing the change number on the left column corresponding to criteria or parameter, shown in Figure 18-6, then answering system questions.

DIALOGUE:

System:

<ENTER THE NUMBER OF PARAMETER TO BE CHANGED >

User:

User enters a number on the left portion of the menu that corresponds to any criteria/parameter he wants to change. The appropriate question will then be asked by the system. Typing a carriage return will exit user from begin mark option.

System:

If begin mark hasn't been selected!

<BEGIN PARAMETERS NOT SET/SELECT BEGIN MARK >

User:

Next select begin mark option

ERROR MESSAGES:

<PROGRAM OR DISK ERROR >

Caused if parameters can't be stored or retrieved from
Disk File Storage.

18-02-02

MENU FOR END MARK

TO CHANGE ANY PARAMETER ENTER * ON LEFT

* PARAMETER

1 CRITERIA (1) CROSS CORRELATION
 (2) CONVOLUTION
 (3) RISE IN TIME WINDOW
 (4) FALL IN TIME WINDOW
 (5) AMPLITUDE LEVEL
 (6) AVERAGE VALUE IN TIME
 (7) AVERAGE POWER IN TIME
 (8) AVER A-C PWR IN TIME
 (9) ZERO CROSSING
 ... (10) END X PTS AFTER BEGIN

2 WIDTH OF SLIDING WINDOW

3 END THRESHOLD

4 THRESHOLD LOGIC ..LT, LE, EQ, GE, GT, NE

5 ADVANCE AFTER WINDOW

6 WINDOW SLIDE ADVANCE

7 NEW PROTOTYPE FOR CROSS CORR. OR CONV.

8 LOCKOUT AFTER TURN ON POINT

9 MAXIMUM LENGTH OF SEGMENT

10 ... SEGMENT LENGTH IF NO END CRITERIA

CR TO EXIT

FIGURE 18-6 DISPLAY IN G.P. REGION ASSOCIATED WITH OPTION 3 OF SEGMENTATION
 FRAME

18-02-03

04 - CREATE MARKERS

GENERAL DESCRIPTION:

This option will form a new tree type consisting of segment markers. These markers can in turn be displayed in the edit module to see how well the automatic segmentation is doing. The marker tree can have the same tree name as the original wave or the user may assign a new name. The marker tree maintains the same tree/node structure as the original wave except a set of markers replace the waveforms. Figure 18-7 shows how the tree structure is preserved in going from the original tree to the marker tree.

DIALOGUE

System:

<ENTER 6 CHAR. MARKER TREENAME - CR FOR CURRENT DATA SET >

User:

Enter 6 character marker tree name or enter current data set
name by hitting carriage return.

System:

<MARKERS ARE BEING CREATED >

User:

No response necessary

ERROR MESSAGES:

< ERROR ... "NAME" ALREADY EXISTS OR ERROR/ENTER

NEW 6 CHAR. TREE NAME >

This error is displayed whenever a marker tree of the same
name as just entered exists on the disk file.

MARKER TREE

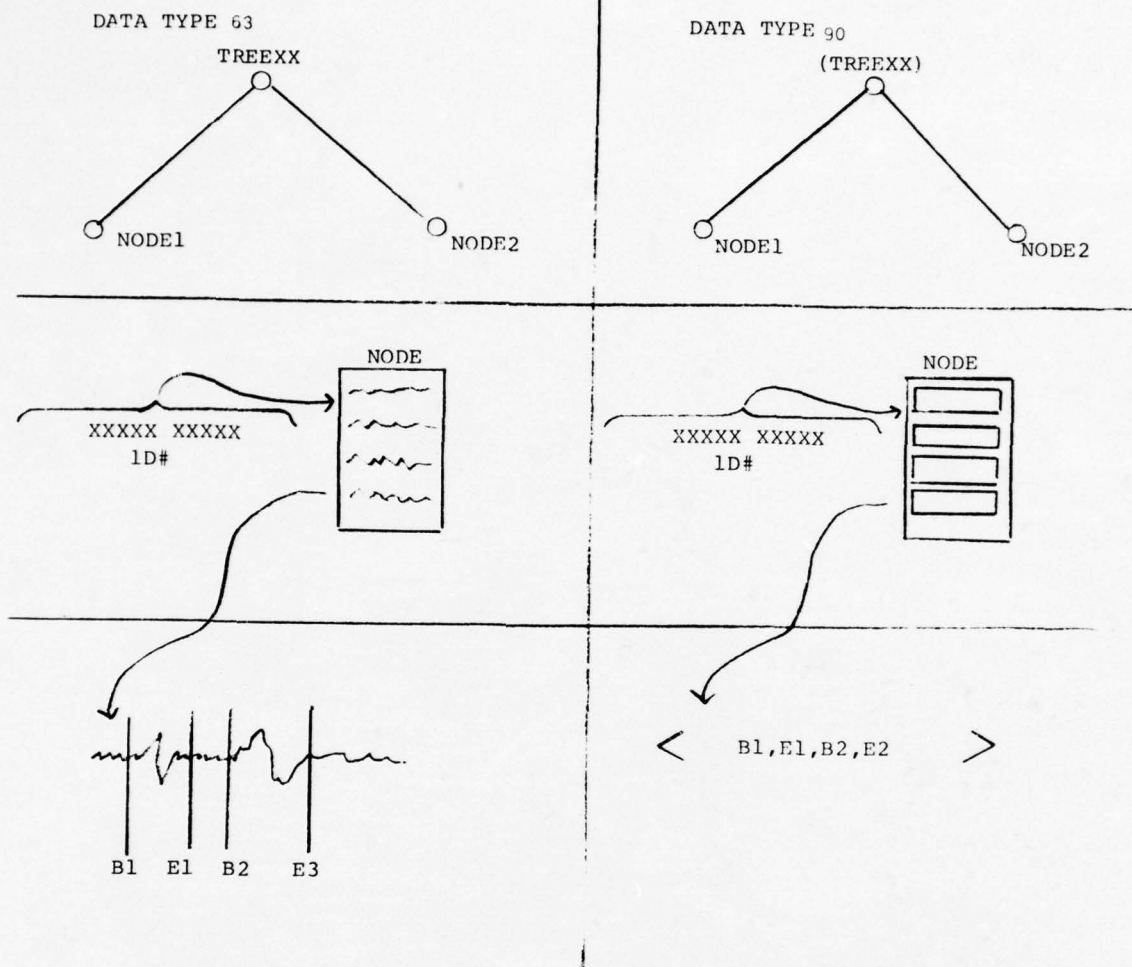


Figure 18-7

CREATION OF MARKER TREE FROM WAVEFORM DATA TREE

< DATA SET NOT SELECTED/SELECT DATA SET >

Enter a new data set

< USER ERROR OR FILE ERROR >

The user has three tries to enter marker tree name. After three tries, if the file name is not accepted, it is assumed the user or file system is in error. This is a fatal error and exit is to light button menu.

< ERROR ... INCONSISTENT DATA/TYPE >

If the current data type selected for segmentation is not waveform data (type 77₈) a fatal error returns user to light buttons. Select data set should be selected next.

SEGMNT

08-03

OPTION

05 - SEGMNT ASSIGNED

GENERAL DESCRIPTION:

This option allows the user to segment data using the previously created marker tree. The same tree structure as the original waveform tree will be maintained along with the same node names. However, the user is required to type a new tree name for segmented data. Figure 18-7 on page 18-04-02 illustrates how the tree structure is preserved from the original tree to the marker tree, and then from the marker tree to the segmented tree.

DIALOGUE:

System:

< ENTER 6 CHAR. TREE NAME FOR SEGMENTED OUTPUT >

User:

Enter 6 character tree name - if the message appears again, name wasn't accepted, try again.

System:

< ENTER 6 CHAR. MARKER TREENAME - CR FOR CURRENT DATA SET >

User:

Enter the tree name of the marker tree you want to operate on the original waveform tree. (Entry into this option without an error message guarantees that at least one marker tree exists on disk file. However, there is at this time no check to see if tree/node structures match and the marker tree name picked may not match the tree structure of the waveform tree to be segmented.)

System:

< SPECIFY ID DIGIT FIELD FOR UPDATES H, L >

User:

Enter the high and low digits of the field you want ID updates
to take place in.

System:

< CLEAR SPECIFIED FIELD (Y,N)? >

User:

Enter Y for Yes - clear field before ID update. Enter N
for No - do not clear field before ID update.

System:

< SEGMENT TREE "NAME" IS BEING CREATED >

User:

No response necessary

ERROR MESSAGES:

< MARKERS NOT CREATED/SELECT *CREATE MARKERS* >

There is no marker tree on disk.

< DATA SET NOT SELECTED/SELECT DATA SET >

Enter new data set.

< USER ERROR OR FILE ERROR >

The user has three tries to enter a segment tree name.

After three tries, if the file name is not accepted, it is

assumed the user or file system is in error. This is a
fatal error and exit is to light button menu.

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SEGMNT

08-03

OPTION

06 - SEGMNT APRIORI

GENERAL DESCRIPTION:

This option will segment data according to manually set markers placed under edit.

NOTE Only the question answer portion of this option has been programmed and is operational. The execution software is for possible development.

DIALOGUE:

System:

< ENTER 6 CHAR. TREE NAME FOR SEGMENTED OUTPUT >

User:

Enter 6 char. tree name - if the message appears again, name wasn't accepted, try again.

ERROR MESSAGES:

< DATA SET NOT SELECTED/SELECT DATA SET >

Enter new data set.

< USER ERROR OR FILE ERROR >

The user has three tries to enter a segment tree name. After three tries, if the file name is not accepted, it is assumed the user or file system is in error. This is a fatal error and exit is to light button menu.

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SEGMNT

08-03

OPTION

07 - CREATE PROTOTYPE

GENERAL DESCRIPTION:

This option will create one prototype waveform as marked in edit.
NOTE Only the question-answer portion of this option has been programmed and is operational. The execution software is for possible development. The prototype will exist as a one node, one wave tree.

DIALOGUE:

System:

< ENTER WAVE SEQUENCE # >

User:

Enter the sequence number of the waveform of the current
data set that is to be used for a prototype waveform.

System:

< ENTER 6 CHAR. PROTOTYPE NAME () >

User:

Enter 6 character name.

System:

< DO YOU WANT PROTOTYPE ADJUSTED TO X POINTS IN WIDTH (Y,N)? >

User:

Enter Y=yes or N=no

If yes, go to S1.

S1 System:

< PROTOTYPE SIZE () = >

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User:

Enter prototype size (up to 1024 points)

ERROR MESSAGES:

< DATA SET NOT SELECTED/SELECT DATA SET >

Enter new data set.

< USER ERROR OR FILE ERROR >

The user has three tries to enter a prototype treename.

After three tries, if the file name is not accepted, it is assumed the user or file system is in error. This is a fatal error and exit is to light button.

SECTION 19

PARLAN FRAME

Frame Name: PARLAN

Call Sequence: 10

PARLAN

PARLAN LANGUAGE FRAME

GENERAL DESCRIPTION:

This frame contains all options available for the user to input, compile, and execute his PARLAN program. (For complete discription see "User's Manual for PARLAN", PAR Report No. 76-8).

<u>OPTIONS</u>	<u>DESCRIPTION</u>
00 - CARD INPUT	19-00-01
01 - ***	
02 - EDIT PROGRAM	19-02-01
03 - COMPILE PROGRAM	19-03-01
04 - EXECUTE PROGRAM	19-04-01
05 - DELETE PROGRAM	19-05-01
06 - PRINT PROGRAM	19-06-01
07 - ***	
08 - ***	
09 - ***	
10 - LIST DIRECTORY	4-00-01
11 - LIST TREES	2-04-01
12 - DRAW TREE	2-05-01
13 - RET TO WPS FRAME	7-1
14 - RET TO INIT FRAME	2-1
15 - HARDCOPY	

PARLAN

OPTION

10

00 - CARD INPUT

GENERAL DESCRIPTION:

This option allows the user to get a PARLAN source program into the WPS system via a card deck. Before the option is selected the user must have punched the PARLAN program on cards (this will be referred to as the source deck). Several control cards will have to be placed on the source deck prior to entering the deck from the card reader.

All control cards will be identified by a "\$" in column 1. The first card at the beginning of each source deck will be of the form:

\$ programe

where programe is the name of the program being entered. A program name may be a combination of from 1 to 6 letters or digits. However, the first character must be a letter. At the end of each source deck entered, there must be a control card of the form

\$END

At the end of all source decks, there should be a control card of the form

\$ENDJOB.

An entire deck thus takes on the form

\$programe₁(source deck for programe₁)
\$END
\$programe₂(source deck for programe₂)
\$END
:
\$programe_n(source deck for programe_n)

\$END

\$ENDJOB

As the cards are being read, a listing of the programs is printed on the line printer.

DIALOGUE:

System:

< CARD INPUT IN PROGRESS >

ERROR MESSAGES:

< CARD INPUT ERROR >

Implies card reader unable to read a card.

May be due to a mispunched card.

< CONTROL CARD SEQUENCE ERROR >

Implies control cards are not in the right order.

< PROGRAM TOO LONG >

Program cannot be read into system because it is too long.

< DELETE ERRORS >

WPS filing system error. Unable to delete a file.

< OPEN ERROR >

WPS filing system error. Unable to open a file.

< PUT ERROR >

WPS filing system error. Unable to put information in a file.

< CLOSE ERROR >

WPS filing system error. Unable to close a file.

< PVEOF ERROR >

WPS filing system error. Unable to put end-of-file on a file.

PARLAN

OPTION

10

02 - EDIT PROGRAM

GENERAL DESCRIPTION:

This option allows the user to edit a PARLAN source file or enter a PARLAN source file from the keyboard. The user enters the name of the source file. If the file is not found in the file directory, the file is created and the editor enters the file input mode. The user must enter the source program from the keyboard. If the file is found in the file directory, the editor enters the edit mode. The user must enter the name of a new source file and a series of edit operation statements. The edit operations are performed on the original source file and stored in the new source file. The original source file remains unchanged.

The edit operation statement consists of a statement number optionally followed by source statement text. Following is a summary of the edit operations:

1. Deletion

An edit statement consisting of a statement number followed by a carriage return indicates deletion. The corresponding statement in the original file is deleted from the new file. (Statement numbers are inserted and used only by the editor. These are independent of statement labels in the source program).

2. Replacement

An edit statement consisting of a statement number followed by source text is considered a replacement operation if the statement number is present in the original file. The source text replaces the text of the original file in the new file.

3. Insertion

An edit statement consisting of a statement number followed by source text is considered an insertion operation if the statement number is not present in the original file. The source text is inserted into the new file depending on the statement number in relation to the original file. That is, to insert a statement between statements 40 and 50 in the original file, a statement number between 41 and 49 must be used. Statements are inserted in numerical order according to statement number, therefore if there are more than one insertion operations with statement numbers between 40 and 50, they will all be inserted between the two statements according to their statement numbers.

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PATTERN ANALYSIS AND RECOGNITION CORP ROME N Y
THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM --ETC(U)
SEP 76 P K SANYAL, C BERSTER, T MCGIBBON F30602-72-C-0193
PAR-76-6 RADC-TR-76-224-VOL-2 NL

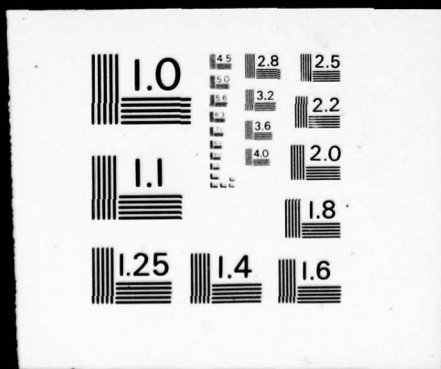
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If more than one edit statement contains the same statement number, the later statement operation is performed, all others are ignored. The statement numbers in the new file are reordered beginning with statement number ten and are in increments of ten.

DIALOGUE:

System:

< ENTER FILE NAME >

User:

The user must enter the name of a source file. If the source file does not exist the following dialogue occurs.

System:

< ENTER STATEMENT (INPUT MODE) (*TO EXIT) >

User:

The user enters the source statement. The dialogue is repeated until the user types a "*" as the first character, instructing the system to close the source file and exit.

If the source file exists in the file directory, the following dialogue occurs.

System:

< ENTER NEW FILE NAME >

User:

The user enters the name of the new source file.

System:

< ENTER STATEMENT #, SPACE, STATEMENT (EDIT MODE) (CR TO EXIT)>

User:

The user enters the edit statement. The dialogue is repeated

until the user types a carriage return as the first character,
instructing the system to perform the edit operations.

System:

< EDITING--WAIT >

ERROR MESSAGES:

< FILING ERROR >

Indicates an error occurred attempting to access the
source file.

< BUFFER IS FULL, EDITING--WAIT >

Indicates the edit buffer is full.

The system performs the edit operations previously entered.

PARLAN

OPTION

10

03 - COMPILE PROGRAM

GENERAL DESCRIPTION:

This option causes a users' PARLAN program to be compiled. Compiling means to convert a source program into a form which is executable (via option 04 - Execute Program). Prior to compiling a source program, the source program must exist in the WPS system. This is accomplished through options 00 - Card Input, or 02 - Edit Program.

The user is referred to the PARLAN users' manual for a complete description of how to write a PARLAN program.

DIALOGUE:

System:

< ENTER PROGRAM NAME >

User:

Respond with the name of the PARLAN program to be compiled followed by carriage return.

ERROR MESSAGES:

<PROGRAM DOES NOT EXIST >

The program name entered does not exist in the system.

<ERROR IN GETTING A VECTOR >

Filing System Error. GETVEC error.

PARLAN

OPTION

10

04 - EXECUTE PROGRAM

GENERAL DESCRIPTION:

The options 00-03 allows the user to input and compile a PARLAN program. Unless a particular PARLAN program is deleted (using option 05 -DELETE PROGRAM), the program remains on the system and the user can choose to have this program executed.

Each program has a parameter list, containing the inputs to the program and the outputs from the program. The system asks a series of questions about these parameters before the execution can begin. It is assumed that the user has familiarized himself with the philosophy of PARLAN from the reference, "On-Line Waveform Processing Language (OLWPL), Preliminary Design" - PAR Report No. 74-8.

DIALOGUE:

System:

< ENTER PROGRAM NAME >

User:

Respond with the 6 character or less program name of the program to be executed.

(1) For each input waveform (W) or vector (V) variable

System:

< "variable" - TREE or PROTOTYPE? (0,1) >

"variable" stands for W1, V3, etc.

User:

If the data to be associated with a variable is a tree, 0 is the response. If the data is a prototype vector or waveform, 1 is the response.

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(2) For each input variable which has a tree associated with it:

System:

< TREENAME? >

User:

A six (or less) character treename is entered. If a carriage return is the response, the current data set is used.

System:

(asked if answer to treename was not a carriage return)

< NODENAME? >

User:

A six (or less) character node name is entered. If the senior node is wanted, carriage return should be entered. Otherwise any subnode under the tree may be selected.

System:

< INITIAL VECTOR #? >

User:

A user may begin processing data at the nth vector. If processing is to begin at other than the first vector, an integer number representing n would be entered here; otherwise, carriage return.

System:

< INCREMENT VECTOR #? >

User:

A user may wish to execute his program on every jth vector. If every vector is not to be processed, an integer number representing j would be entered here. Else, carriage return.

System:

< WHAT OUTPUT VARIABLES ARE TO HAVE THE SAME TREE STRUCTURE
AS "VARIABLE"? >

"Variable" stand for W1, V3 etc. from the input portion of
the parameter list.

User:

User responds with the names of the output variables which are
to have the same tree structure as this input variable separated
by spaces or commas (e.g., W3, V1, W2, or W3).

System:

The system then asks, for each variable in the above response,
the questions associated with each output waveform or vector.

See part (5) "For each output waveform (W) or vector (V) variable"
for these questions.

(3) For each input variable which is associated with a prototype.

System:

< TREENAME? >

User:

The first vector in the tree specified is used as the prototype.

The user should respond with the tree name that contains the
prototype.

(4) For each input I or F variable

System:

< "VARIABLE" =? > e.g. < I =? >

User:

The value that should be assigned to this variable would be
entered here.

(5) For each output waveform (W) or vector (V) variable

System:

<"VARIABLE" - TREE, PRINT, NO ACTION? (0, 1, 2)>

User:

If the output variable is to be associated with a tree, response 0 should be entered. If the values of the output variable are to be printed for each input vector, response 1 would be entered. If no action is to be associated with this variable, response 2 would be entered. The last option is provided because the current user may not be interested in certain outputs of a packaged program.

(6) For each output variable to be associated with a tree

System:

<TREENAME?>

User:

Respond with 6 character (or less) treename to be associated with this variable.

The following question is asked if the variable is a waveform

System:

<TIME OR FREQUENCY DOMAIN? (0, 1) >

User:

If the data to be created under this tree is time domain data, 0 is entered. If frequency domain data, 1 is entered.

System:

<ISOMORPHIC OR POLYMORPHIC TRANSFORMATION? (CR,1)>

User:

If only one waveform vector is created from each input waveform or vector, the transformation is "ISOMORPHIC" (one-to-one).

Use CR.

If more than one waveform vector is created from each input waveform or vector, then it is a "POLYMORPHIC" transformation (one-to-many). Enter 1.

[Each waveform or vector under a given tree, has a unique ID number. When a new waveform or vector is created under an isomorphic transformation, it has the same ID as the input waveform or vector. If a single waveform or vector undergoes a polymorphic transformation and spawns more than one waveform or vector, then new ID's are necessary for the additional waveforms or vectors. This is done by changing a specified field of the input ID number, which consists of ten decimal digits. The field is specified by entering the "beginning and end" location of the field. Therefore, if a polymorphic transformation is indicated, then the following questions are asked.]

System:

<BEGINNING ID GENERATION DIGIT? >

User:

Enter a number 0-9

System:

< END ID GENERATION DIGIT? >

User:

Enter a number \geq the number entered above.

(7) For each output I or F variable.

System:

< "VARIABLE" - NO ACTION, PRINT? (0,1)>

User:

If the value of the variable is to be printed each time the routine is executed, 1 should be the response. Else, 0 should be entered.

ERROR MESSAGES:

User Errors:

< ("NAME") NON EXISTENT PROGRAM >

If the program name entered or any programs called by this program do not correspond to any PARLAN program existing in the system, this error occurs. "NAME" corresponds to the actual name of the non-existent program. The system then returns to the menu.

< INCONSISTENT, REENTER TREENAME >

In (2), if the response to the treename question is carriage return and the data type of the variable is not the same as

the data type of the current data set, this message occurs.

The user should respond with the correct treename.

<"VARIABLE" DOES NOT EXIST, WHAT SHOULD IT BE? >

In (2), if a variable name (i.e., W1, V3, etc.) in the response to the question < WHAT OUTPUT VARIABLES ARE TO HAVE THE SAME TREE STRUCTURE AS "VARIABLE" > is incorrect or does not exist in the program, this error occurs. The user should respond with the correct variable name. A carriage return should be entered if no variable is to replace this variable.

<THIS PROGRAM CAN NOT FIT IN CORE >

In trying to link the program, there is not enough room in core for the routine and all its subroutines. If this condition occurs, the above error occurs. The user must then find a new way to write his program.

System Errors:

The following errors occur if PARLAN has made an error or if the WPS filing system has made an error.

< LINK ERROR >

< CONVERSION ERROR-ABORT >

< OPEN ERROR - ABORT >

< GETWAV ERROR - ABORT >

< OPONOD ERROR - ABORT >

< CREATE ERROR - ABORT >

< FILING SYSTEM ERROR >

< PVELF ERROR - ABORT >

< CLOSE ERROR >

< GET ERROR >

< CLOSE ERROR - PASS 3 >

The user will not be interested in the causes of the above errors and hence no explanation is added here. User should contact "maintenance" in case of above error messages.

PARLAN

OPTION

10

05 - DELETE PROGRAM

GENERAL DESCRIPTION:

This option allows the user to delete selected PARLAN programs. All references to the program are deleted.

DIALOGUE:

System:

<ENTER PROGRAM NAME, CR TO STOP >

User:

The user should enter the name of the PARLAN program to be deleted followed by a carriage return. A program name has less than or equal to 6 characters.

After the program is deleted, the dialogue is repeated. To terminate deletion of programs, only a carriage return should be entered in place of a program name.

ERROR MESSAGES:

None

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PARLAN

OPTION

10

06 - PRINT PROGRAM

GENERAL DESCRIPTION:

This option allows the user to print out on the line printer a source listing of a selected PARLAN program (see options 00-CARD INPUT and 02-EDIT PROGRAM for methods to enter a PARLAN program).

DIALOGUE:

System:

< ENTER PROGRAM NAME, CR TO STOP >

User:

The user should enter the name of the PARLAN program to be printed followed by a carriage return. A program name has less than or equal to 6 characters.

After the program is printed, the dialogue is repeated. To terminate printing, a carriage return should be entered in place of a program name.

ERROR MESSAGES:

< NON-EXISTENT PROGRAM - REENTER > - the program selected does not exist, the user is asked to re-enter the program name.

< GETVEC ERROR > - Filing System Error

< CLOSE ERROR > - Filing System Error

19-06-01

SECTION 20

INITIAL FRAME FOR OLPARS

Frame Name: OLPFPM

Call Sequence: 09

OLPARS INITIAL FRAME

GENERAL DESCRIPTION:

This is the initial OLPARS frame. Any subsequent operations will be on vector data sets (data type 13). Most subsequent operations will expect a current data set to be defined. This may be done via select data set (11).

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 STRUCT ANAL	21-1
01 MEASURE EVAL	25-1
02 TRANSFORMS	29-1
03 DF LOGIC DESIGN	30-1
04 EDIT NAME & SAVE	38-1
05 Blank	
06 "	
07 "	
08 "	
09 "	
10 "	
11 SELECT DATA SET	8-13-1
12 LIST TREES	2-04-1
13 DRAW TREE	2-05-1
14 RET INIT FRM	2-1
15 HARDCOPY	

OPTION

11 - SELECT DATA SET

GENERAL DESCRIPTION:

User identifies a tree and node as the "current data set". The data type is understood to be 13, i.e., vector data.

DIALOGUE:

System:

< ENTER TREE NAME >

User:

- a. Up to 6 characters are entered designating a vector tree.
- b. <CR> implies the previous tree name is designated.

System:

< ENTER NODE NAME >

User:

- a. 5 characters or less are entered.
- b. CR implies the previous node name is designated.

ERROR MESSAGES:

< NON-EXISTENT FILE >

Data set selected does not exist; reselect

SECTION 21

STRUCTURE ANALYSIS FRAME

Frame Name: STRANL

Call Sequence: 09-00

STRANL

09-00

STRUCTURE ANALYSIS FRAME

GENERAL DESCRIPTION:

This is the initial frame for structural analysis functions under OLPARS. Before selecting options (00-05) a current data set must be selected in a previous frame or via SELECT DATA SET (10).

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 EIGENVECTORS	21-00-01
01 COORD VECTORS	21-01-01
02 Blank	
03 ARBITRARY VECS	21-03-01
04 FISHER VECTORS	21-04-01
05 Blank	
06 "	
07 "	
08 "	
09 "	
10 SELECT DATA SET	8-13-01
11 LIST TREES	2-04-01
12 DRAW TREE	2-05-01
13 RET OLPARS FRM	20-1
14 RET INIT FRM	2-1
15 HARDCOPY	

OPTION

00 - EIGENVECTORS

GENERAL DESCRIPTION:

This option computes the eigenvectors and eigenvalues of the covariance matrix of the current data set. The computation uses the Jacobi method and is limited to 70 dimensional data.

The eigenvalues are rank ordered and displayed on the Vector General. The user may then designate one or two eigenvalues. A histogram or scatter plot consisting of the projection of the current data set onto the eigenvectors corresponding to the selected eigenvalues will be produced. Designation of a single eigenvalue will cause a histogram to be produced. Designation of two eigenvalues will cause a scatter plot to be produced. The x-axis for the scatter plot will be the eigenvector corresponding to the first eigenvalue designated.

DIALOGUE:

System:

< TYPE IN VECTOR NUM OR CR TO TERMINATE >

User:

The user may respond with one of the following inputs:

a. N CR CR

b. N CR
N CR

where N is an integer number corresponding to the rank of the eigenvalue desired. The first option will cause a histogram to be produced and the second option will cause a scatter plot to be produced.

ERROR MESSAGES:

<DISC I/O ERROR >

Indicates an error occurred in attempting to access a file.

User should insure that a current data set is defined.

NEXT FRAME:

1SPACE - if histogram is selected

2SPACE - if scatter plot is selected

OPTION

01 - COORD VECTORS

GENERAL DESCRIPTION:

This option displays the symbols C1 thru CN (where N is the number of dimensions in the current data set) on the Vector General console to represent the N measurements. The user may then designate one or two of the measurements. A histogram or scatter plot of the current data set along the measurements selected will be produced. Designation of a single measurement will cause a frequency histogram to be produced. Designation of two measurements will cause a scatter plot to be produced. The x-axis for the scatter plot will correspond to the first measurement designated.

DIALOGUE:

System:

< TYPE IN VECTOR NUM OR CR TO TERMINATE >

User:

The user may respond with one of the following inputs:

- a. N CR CR
- b. N CR
N CR

where N is an integer number corresponding to the measurement desired. The first option will cause a histogram to be produced and the second option will cause a scatter plot to be produced.

ERROR MESSAGES:

< DISC I/O ERROR >

Indicates an error occurred in attempting to access a file.

User should insure a current data set is defined.

NEXT FRAME:

1SPACE - if histogram is selected

2SPACE - if scatter plot is selected

OPTION

03 - ARBITRARY VECS

GENERAL DESCRIPTION:

This option allows the user to designate one or two vectors previously saved via the NAME & SAVE options in the 1SPACE and 2SPACE frames.

A list of the saved vector names along with a sequence number is displayed on the Vector General console. The user may then designate one or two of the sequence numbers. A histogram or scatter plot consisting of the projections of the current data set onto the vectors corresponding to the sequence numbers selected will be produced. Designation of a single number will cause a histogram to be produced. Designation of two numbers will cause a scatter plot to be produced. The x-axis for the scatter plot will be the vector corresponding to the first number designated.

DIALOGUE:

System:

< TYPE IN VECTOR NUM OR CR TO TERMINATE >

User:

The user may respond with one of the following inputs:

a. N CR CR

b. N CR
N CR

where N is an integer number corresponding to a sequence number being displayed. The first option will cause a histogram to be produced and the second option will cause a scatter plot to be produced.

ERROR MESSAGES:

<DISC I/O ERROR >

Indicates an error occurred in attempting to access a file.

User should insure a current data set is defined.

< NO FILE OR NDIM DOESN'T MATCH - TRY AGAIN >

Indicates the number input is not being displayed or that the vector selected does not have the same number of measurements as the current data set.

NEXT FRAME:

1SPACE - if histogram is selected

2SPACE - if scatter plot is selected

OPTION

04 - FISHER VECTORS

GENERAL DESCRIPTION:

This option allows the user to designate two classes from the list of current lowest modes. The covariance matrices of the two classes selected will be used to compute the Fisher discriminant plane vectors.

A list of symbols for the lowest modes in the current TREE/NODE are displayed on the Vector General console. The user designates two of the symbols from the list. The user then designates a histogram or scatter plot to be produced. The histogram is a projection of the current data set onto the Fisher axis. The scatter plot is a projection of the current data set on to the Fisher discriminant plane, with the x-axis corresponding to the Fisher axis.

DIALOGUE:

System:

< TYPE IN TWO SYMBOLS - NO SPACES >

User:

Type in two symbols from the list displayed on the VG console.

System:

< TYPE CR TO RESELECT - 1 FOR HISTOGRAM - 2 FOR SCATTER PLOT >

User:

CR to reselect class pair

1 - To select histogram

2 - To select scatter plot

ERROR MESSAGES

< ERROR IN COMPUTATION, TYPE CR TO RESELECT - 1 TO EXIT >

An I/O error occurred during computation or an invalid class pair

was selected or a computation error occurred. User can try
another pair to type 1 to exit.

NEXT FRAME:

1SPACE - if histogram is selected

2SPACE - if scatter plot selected

SECTION 22

ONE SPACE PLOT FRAME

Frame Name: 1SPACE

Call Sequence: 09-00-00

STRUCTURE ANALYSIS HISTOGRAM PLOT

GENERAL DESCRIPTION:

This frame accompanies the 1 space histogram plot under structure analysis. Its options deal primarily with manipulations of the basic plot. Other important options provide for the saving of projection vectors and the partitioning of the current data set.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 SELECT CLASSES	22-00-01
01 CHNGE BIN PARAMS	22-01-01
02 CHNGE PAGE SIZE	22-02-01
03 DISP BIN COUNT	22-03-01
04 ZOOM OPTIONS	24-1
05 COMPARE CLASSES	22-05-01
06 LOCAL VERT SCL	22-06-01
07 GLOBAL VERT SCL	22-07-01
08 NEXT CLASS	22-08-01
09 NEXT PAGE	22-09-01
10 NAME & SAVE	22-10-01
11 SET THRESHOLDS	22-11-01
12 PARTITION	22-12-01
13 SELECT BASIS	22-13-01
14 RET STRUCT ANAL	21-1
15 HARDCOPY	

OPTION

00 - SELECT CLASSES

GENERAL DESCRIPTION:

This option allows the user to select by name the histograms of any classes in the data set. A maximum of ten selections can be made with the light pen and then, viewing the display from bottom to top, the histograms of the chosen classes are presented to the user in the order of their selection. The normal order of the histograms can be restored by the CHNGE PGE SIZE option (02) or the NEXT PAGE option (09). The NEXT CLASS option (08) continues to function as described. All other options except for SELECT BASIS (13) maintain the selected order.

When the option is chosen the frame option menu is temporarily destroyed and replaced by a list of the current class (node) names. To select a class, the user moves the light pen over this list. A small arrow indicates which class name the light pen senses. When the arrow is positioned before the proper class, the user presses the light pen switch. A number from one to ten will appear next to the class name, indicating both that the class has been selected and the number of selections which have been made. Once ten selections have been made, further light pen activity is ignored.

The user responds with a carriage return at any time and the selected histograms will be displayed. If the user does not select any classes, the current display will not be affected.

DIALOGUE:

System:

< LIGHTPEN CLASSES (10 MAXIMUM). TYPE / TO RE-SELECT, ANYTHING ELSE
= CR TO PROCEED. >

User:

The user can respond with one of the following inputs:

a. / CR

b. < X > CR

Option (a) clears all the selection numbers so that the user can
reselect the classes. In option (b) < X > signifies that the input

is not important. Anything but (a) terminates the option.

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

1SPACE

09-00-00

OPTION

01 - CHANGE BIN PARAMETERS

GENERAL DESCRIPTION:

This option allows the user to change one of two scaling factors of the histogram plot: (1) the number of bins or (2) the size of a bin. The histogram will be completely recalculated on the basis of the user's input.

DIALOGUE:

System:

< SELECT OPTION: A=CHANGE # OF BINS, B=CHANGE BIN SIZE. >

User:

a. A and CR

b. B and CR

Option (a)

System:

< ENTER # OF BINS. MAXIMUM = 100. >

User:

N and CR (where N equals the new number of bins).

Option (b)

System:

< ENTER NEW BIN SIZE. >

User:

E and CR (E is a number not to exceed 20 characters. E can be in exponential format).

22-01-01

System:

< DO YOU WANT TO KEEP THE SAME # OF BINS? (Y=YES) >

User:

- a. Y and CR
- b. CR

System:

< NEW RANGE MUST BE COMPUTED. TYPE: A=KEEP SAME MINIMUM,
B=KEEP SAME MAXIMUM, C=KEEP SAME MIDPOINT >

User:

- a. A and CR
- b. B and CR
- c. C and CR

The range of the data is the product of the bin size and the number of bins. The range is expanded or decreased by (a) increasing or decreasing the maximum, (b) decreasing or increasing the minimum or (c) decreasing the minimum and increasing the maximum or increasing the minimum and decreasing the maximum.

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< MAXIMUM=100, TRY AGAIN >

The user has selected too many bins).

<FORMAT ERROR, NEW BIN SIZE=? >

(The string of characters that the user typed could not be interpreted as a number.

<ERROR: RANGE OF DATA = Ø >

<FILE ACCESS ERROR >

(The data set could not be retrieved).

NEXT FRAME:

1SPACE

22-01-03

1SPACE

09-00-00

OPTION

02 - CHNGE PAGE SIZE

GENERAL DESCRIPTION:

This option allows the user to change the number of histograms displayed per page. The number of pages is set equal to the total number of classes divided by the number of histograms per page (plus 1 if there is a remainder) and the histograms for the current page or for page one, if the current page no longer exists, are then replotted. The new paging scheme is retained over all other options in the frame except the SELECT BASIS option (13).

Pages are originally defined after the select histogram option (see STRANL) and before the 1SPACE frame is displayed. At that time, the number of pages is set equal to the number of classes divided by ten (plus 1 if there is a remainder). Ten is the maximum number of histograms allowed per page. If there are fewer than ten classes, then there is only one page and the number of histograms per page is equal to the number of classes.

The number of histograms per page determines the size of the histograms. That is, as the number of histograms decreases, the lengths of the vertical lines which represent the bin counts increase. Note that (1) the scaling is dependent on the allotted number of histograms per page, not the number on the current page and (2) histograms which are plotted one per page are the same size as those plotted two per page.

DIALOGUE:

System:

<ENTER # OF LINES PER PAGE. MAXIMUM = 10. >

User:

N CR

where N is an integer from one to ten.

ERROR MESSAGES:

<MAXIMUM = 10. TRY AGAIN. >

User response must be less than or equal to ten. The system expects the user to respond again.

22-02-01

NEXT FRAME:

1SPACE

22-02-02

1SPACE

09-00-00

OPTION

03 - DISP BIN COUNT

GENERAL DESCRIPTION:

This option displays the number of vectors of each class on the current page contained in any user selected bin. The user moves a small arrow across the top of the display by means of potentiometer or control dial 1. As the arrow moves from one bin to another a message of the form BIN N, COUNT = C is displayed in the lower left hand corner of each histogram. N is the number of the bin to which the arrow is pointing and C is the number of vectors of the given class which are in that bin.

DIALOGUE:

System:

< DIAL 1 ACTIVE. TYPE CR TO ESCAPE. >

User:

CR

The user responds with a carriage return to terminate the option.

The bin count messages disappear.

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

22-03-01

1SPACE

09-00-00

OPTION

05 - COMPARE CLASSES

GENERAL DESCRIPTION:

This option allows the user to compare displayed classes by vertically moving the image of any selected histogram over the display space.

The user activates a class by passing the light pen with the switch pressed over the histogram on the display. Once a class is activated a second image of the histogram appears on the screen and is moved vertically by use of potentiometer or control dial 1. The user deactivates a class by activating another or by terminating the option. The option is terminated with a keyboard response.

DIALOGUE:

System:

< ACTIVATE CLASS WITH LIGHT PEN. MOVE CLASS WITH CONTROL DIAL 1.

TYPE < CR> TO ESCAPE.>

User:

CR The user types CR to terminate the option.

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

22-05-01

1SPACE

09-00-00

OPTION

06 - LOCAL VERT SCL

GENERAL DESCRIPTION:

This option changes the scale of the histogram so that vertical scaling is class dependent. The maximum bin count in each class will be represented by a line that is the same length in every class, but which does not necessarily indicate that the bin counts are identical. All other bin counts will be plotted relative to the maximum bin count of the same class.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

22-06-01

1SPACE

09-00-00

OPTION

07 - GLOBAL VERT SCL

GENERAL DESCRIPTION:

This option changes the scale of the histogram so that vertical scaling is not class dependent. The maximum bin count over the entire data set determines the length of the longest line on the display. The lengths of all other lines are determined relative to the maximum. Lines of equal length, therefore, represent identical bin counts.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

1SPACE

09-00-00

OPTION

08 - NEXT CLASS

GENERAL DESCRIPTION:

This option displays the histogram of the next available class. It is a scrolling option. The first class on the display is removed, all other classes move down and the new class appears at the top of the display. The actual class that will appear can be predicted only if the user knows the structure of the data set (classes appear in reverse order to the data tree) and if the user has not previously selected option 00 - SELECT CLASSES.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

22-08-01

1SPACE

09-00-00

OPTION

09 - NEXT PAGE

GENERAL DESCRIPTION:

This option displays the histograms of the next page of classes. The number of pages T in a histogram plot equals the number of classes C divided by the number of classes per page N (plus 1 if there is a remainder). Taking the classes in the reverse order to which they appear in the data tree, this option displays the Pth class, where P is the number of the next page, and every class that follows until there are N displays or no more classes.

N is originally set to 10 or C whichever is smaller. The user can modify N through option 02 - CHNGE PAGE SIZE.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

1SPACE

1SPACE

09-00-00

OPTION

10 - NAME AND SAVE

GENERAL DESCRIPTION:

This option saves the basis vector used to generate the displayed histograms. The basis vector is stored in the arbitrary vector file.

DIALOGUE:

System:

< 6 CHARACTER NAME >

User:

Input through the VG keyboard a 6 character name to be associated with the basis vector being stored.

ERROR MESSAGES:

< FILE FULL >

Arbitrary vector file is full. Go to Name and Save frame to delete vectors to make room for new vectors.

< FILE ERROR >

System I/O error, check hardware.

22-10-01

1SPACE

09-00-00

OPTION

11 - SET THRESHOLDS

GENERAL DESCRIPTION:

This option allows the user to define a maximum of four thresholds for purposes of partitioning the data set. The thresholds are vertical line segments which extend to the upper and lower limits of the display. The user positions them on the display with the control dials. Reselecting this option destroys the thresholds.

DIALOGUE:

System:

(Draws a threshold on the display)

< DIAL 1 ACTIVE. TYPE <CR> TO FIX LINE, <*> <CR> TO ESCAPE. >

User:

(Positions threshold with control dial)

a. CR

b. * and CR

Option (a) fixes the threshold on the screen and if there are not four thresholds on the display repeats 1. If there are four thresholds the overall option is terminated.

Option (b) erases the moving threshold from the screen and terminates the overall option.

ERROR MESSAGES:

None

22-11-01

NEXT FRAME:

1SPACE

22-11-02

OPTION

12 - PARTITION

GENERAL DESCRIPTION:

This option performs a division of a single vector data node into two or three subnodes. The user specifies the subclasses via the "Set Thresholds" option. The logic used to determine subclass membership is the same used in the Distribution Tree histogram plot. For the subclasses defined, a new vector data node and covariance file are created. The vector data file associated with the node selected for subdivision is deleted.

DIALOGUE:

System:

< TYPE IN PLOT SYMBOL FOR PARTIONED CLASS >

User:

A CR where A is a plot symbol in the current vector data tree.

System:

< SELECT REGION 1: L=LEFTMOST, R=RIGHTMOST >

User:

a. L CR

b. R CR

For each region i designated by the threshold settings, the following sequence is executed:

System:

Display region number in appropriate area on screen

<TYPE IN FIVE CHAR NODE NAME FOR DATA IN REGION i >

User:

AAAAA CR, where AAAAA is a unique five character node name for the subclass in region i. The fifth character will be used as the plot symbol.

System:

< WAIT - CREATING SUBCLASSES >

User:

No response required

System:

< STAT COMP >

User:

No response required

ERROR MESSAGES:

< NO BOUNDARIES EXIST >

User has failed to draw any thresholds.

< I/O ERROR >

Data set could not be retrieved.

NEXT FRAME:

STRANL

1SPACE

09-00-00

OPTION

13 - SELECT BASIS

GENERAL DESCRIPTION:

The 1SPACE frame is called in via the options EIGENVECTOR, COOR VECTORS, ARBITRARY VECS and FISHER VECTORS. The option SELECT BASIS allows the user to reselect the basis vectors for the display.

Suppose the One Space Plot Frame (1SPACE) resulted from selecting EIGENVECTOR option in Structure Analysis Frame (STRANL). Then, the dialogue and the display in the GP region following the selection of the SELECT BASIS option is exactly the same as that following the original selection of the EIGENVECTOR option. The menu displayed remains that of the 1SPACE frame, unless the user indicates a scatter plot by selecting two basis vectors. In the latter case, the Scatter Plot Frame is brought in.

DIALOGUE:

See EIGENVECTOR (page 21-00-01), COOR VECTOR (page 21-01-01),
ARBITRARY VECS (page 21-03-01) and FISHER VECTORS (page 21-04-01),
as appropriate.

ERROR MESSAGES:

As above.

SECTION 23

TWO SPACE PLOT FRAME

Frame Name: 2SPACE

Call Sequence: 09-00-00

STRUCTURE ANALYSIS SCATTER PLOT

GENERAL DESCRIPTION:

This frame accompanies the 2SPACE scatter plot under structure analysis. Its options deal primarily with manipulations of the basic plot. Other important options provide for the saving of projection vectors and the partitioning of the current data set.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 NEXT PAGE	23-00-01
01 CHANGE SCALE	23-01-01
02 PRINT ID'S	23-02-01
03 BLINK	23-03-01
04 ELIMINATE	23-04-01
05 NAME AND SAVE	23-05-01
06 Blank	
07 ZOOM	23-07-01
08 DRAW BOUNDARY	23-08-01
09 PARTITION	23-09-01
10 SELECT BASIS	22-13-01
11 Blank	
12 RET STRUCT ANAL	21-1
13 RET OLPARS FRM	20-1
14 RET INIT FRM	2-1
15 HARDCOPY	

2SPACE

09-00-00

OPTION

00 - NEXT PAGE

GENERAL DESCRIPTION:

This option plots the next page of vectors in the current data set. They are plotted according to the current scaling parameters as set by default, the CHANGE SCALE option (01), or the ZOOM option (07). Paging and scaling information is displayed along with the plot.

Pages are defined after the user selects the scatter plot option (see STRANL) and before the 2SPACE frame is displayed (at which time page 1 is plotted). The number of pages in the plot (p) is equal to the total number of vectors (T) in the data set divided by 500 (plus 1, if there is a remainder). The number of vectors on a page is equal to T divided by p (minus 1 on the pth page if T divided by p leaves a remainder). If x is any page, then a given vector belongs to x if, taken in order of its appearance in the data set, it can be labeled as the $(x+Np)^{th}$ vector, where $N=0,1,2...(T/p-1)$. If the current page is the last page, then the first page will be replotted.

DIALOGUE:

None

ERROR MESSAGES:

< FILE ACCESS ERROR >

Indicates an error occurred in attempting to access a data file.

Although it could be caused by a fault in the structure of the data file, it is most likely a hardware error.

NEXT FRAME:

2SPACE

23-00-01

OPTION

01 - CHANGE SCALE

GENERAL DESCRIPTION:

This option changes the scaling parameters and replots the current page of vectors. These parameters are used to map the floating point vectors of the data set to the display screen coordinate system. Their default values as set after the user selects the scatter plot option (see STRANL) and before the 2SPACE frame is displayed are: Global Scale and Square Scale. Scaling and paging information is displayed along with the plot.

The scaling parameters are defined as follows:

Global Scale	The scale based on the minimum and maximum values of the dot product of all vectors in the data set with the projection vectors selected in STRANL.
Local Scale:	The scale based on the minimum and maximum values of the dot product of all vectors on the current page with the projection vectors selected in STRANL.
Zoom Scale:	The scale based on the minimum and maximum values in the x and y directions as determined by the user in the ZOOM option (07).
Rectangular Scale:	The scaling of the x and y directions independently, allowing for maximum use of the display screen.
Square Scale:	The scaling of the x and y directions identically so that equal changes in the x and y coordinates on the screen represent equal changes in the actual x and y values of the projected vectors. The scaling factor of the direction with the greatest range is used.

A plot is either Global, Local or Zoom and Rectangular or Square. Thus in this option the user selects Global or Local and/or Rectangular or Square. Zoom is selected by the ZOOM option (07) and is altered or abandoned by selections in the CHANGE SCALE option.

DIALOGUE:

System:

<SELECT SCALE: G(GLOBAL), L(LOCAL), R(x≠y), S(x=y), GR, GS, LR, or LS.>

User:

The user can respond with one of the following inputs:

- a. G CR
- b. L CR
- c. R CR
- d. S CR
- e. GR CR
- f. GS CR
- g. LR CR
- h. LS CR

Option (a) selects Global Scale, (b) selects Local, (c) selects Rectangular, (d) selects Square, (e) selects Global and Rectangular, (f) selects Global and Square, (g) selects Local and Rectangular, and (h) selects Local and Square.

ERROR MESSAGES:

None

NEXT FRAME:

2SPACE

2SPACE

09-00-00

OPTION

02 - PRINT ID'S

GENERAL DESCRIPTION:

This option prints on the line printer the ID number, class symbol, and unscaled x, y projection values of user indicated vectors. The user holds the light pen against any plotted class symbol (representing a vector), waits for the plot to respond to the selection, and then presses the light pen switch. (The plot responds to the selection by increasing the size of the class symbol which the light pen senses). All vectors which are currently plotted and whose display coordinates are equal to the display coordinates of the selected symbol are then output to the line printer in the form:

Vector ID	Class Symbol	Measurement X	Measurement Y
-----------	--------------	---------------	---------------

The user repeats this sequence as often as he likes and terminates the option through a keyboard response.

DIALOGUE:

System:

< LIGHT PEN VECTOR. TYPE < CR > TO ESCAPE. >

User:

CR User terminates the option with a carriage return when he has finished selecting vectors with the light pen.

ERROR MESSAGES:

None

The user should note that the option prints header information on the line printer prior to displaying the system dialogue message. If the message fails to appear, the user should insure that the line printer is on line.

23-02-01

NEXT FRAME:

2SPACE

23-02-02

OPTION

03 - BLINK

GENERAL DESCRIPTION:

This option controls the display blink function allowing the user to cause all the vectors of any selected class to blink on and off when plotted. Once enabled, a class continues to blink over all other options in this frame, excluding the Select Basis option (10).

The user selects classes for blinking with the light pen. The frame option menu is temporarily destroyed and replaced by a list of class symbols. Each class symbol is preceded by a beta (β), indicating that the class is blinking, an epsilon (ϵ), indicating that the class has been eliminated, or a blank. The user moves the light pen over this list and an arrow keeps track of the last class symbol sensed by the light pen. When the user presses the light pen switch, action is taken on the class to which the arrow is pointing. If the class is not blinking, the blink is enabled and a β is displayed before the class. If the class is blinking, the blink is disabled and the β removed. (If the class is eliminated the attempted action will be ignored.) Once action has been taken on a class, the arrow must be moved to another class before any further action can take place. After moving the arrow, the user can reselect the previous class or any other class in the list.

DIALOGUE:

System:

< LIGHT PEN ACTIVE. TYPE: < / > TO CLEAR ALL, < CR > TO ESCAPE >

User:

The user can respond with one of the following inputs:

- a. / CR
- b. / CR CR
- c. CR

Option (a) disables the blink for all classes. Option (b) disables the blink for all classes, terminates the BLINK option, and restores the frame option menu. Option (c) terminates the BLINK option and

restores the frame option menu.

ERROR MESSAGES:

None

NEXT FRAME:

2SPACE

OPTION

04 - ELIMINATE

GENERAL DESCRIPTION:

This option allows the user to eliminate all vectors of any selected class from the display. Once a class is eliminated it remains undisplayed over all other options in this frame, excluding the Select Basis option (10). Since the elimination is purely a display function, scaling parameters and the paging scheme are not affected.

The user selects classes for elimination with the light pen. The frame option menu is temporarily destroyed and replaced by a list of class symbols. Each class symbol is preceded by an epsilon (ϵ) indicating that the class has been eliminated, a beta (β), indicating that the class is blinking, or a blank. The user moves the light pen over this list and an arrow keeps track of the last class symbol sensed by the light pen. When the user presses the light pen switch, action is taken on the class to which the arrow is pointing. If the class has not been eliminated, it is eliminated and a ϵ is displayed before the class. If the class has been eliminated, it is restored and the ϵ removed. (If the class is blinking the attempted action will be ignored.) Once action has been taken on a class, the arrow must be moved to another class before any further action can take place. After moving the arrow, the user can reselect the previous class or any other class in the list.

DIALOGUE:

System:

< LIGHT PEN ACTIVE.TYPE: < / > TO CLEAR ALL, < CR > TO ESCAPE >

User:

The user can respond with one of the following inputs:

- a. / CR
- b. / CR CR
- c. CR

Option (a) restores all classes. Option (b) restores all classes, terminates the ELIMINATE option, and restores the frame option menu. Option (c) terminates the ELIMINATE option and restores the frame option menu.

ERROR MESSAGES:

None

NEXT FRAME:

2SPACE

2SPACE

09-00-00

OPTION

05 - NAME & SAVE

GENERAL DESCRIPTION:

This option saves either the x or y basis vectors used in generating the displayed scatter plot. The user selected basis vector is stored in the arbitrary vector file.

DIALOGUE:

System:

< X OR Y AXIS >

User:

"X" "CR" to save basis vector that forms the x coordinates in the scatter plot.

"Y" "CR" to save basis vector that forms the y coordinates in the scatter plot.

System:

< 6 CHARACTER NAME >

User:

Input a 6 character name to be associated with the basis vector being stored.

2SPACE

09-00-00

OPTION

07 - ZOOM

GENERAL DESCRIPTION:

This option allows the user to magnify any area of the displayed plot. When the option is selected a square appears on the display screen. The user manipulates the position and size of the square to define an area for magnification. Potentiometer 1 or Control Dial 1 controls the positioning of the square in the x direction, dial 2 controls the positioning in the y direction, and dial 3 controls the size of the square. The user defined area is then translated and expanded to fill the entire display coordinate space, rescaling all vectors that are within that area and excluding all that are not. The user can restore the original plot through the CHANGE SCALE option (01). Until then, the zoom effect remains active over all other options in this frame, except the Select Basis option (10).

DIALOGUE:

System:

< DIALS 1-3 ACTIVE. TO FREEZE BOX AND PROCEED TYPE < CR > >

User:

CR The user responds when the square defines the desired area of the plot.

ERROR MESSAGES:

<ERROR: SELECTED RANGES ≤ 0 >

Indicates that the selected range is unplotable.

NEXT FRAME:

2SPACE

23-07-01

OPTION

08 - DRAW BOUNDARY

GENERAL DESCRIPTION:

This option allows the user to draw a maximum of two, six segment boundaries on the displayed plot for the purpose of creating two space logic. The boundaries are drawn with the data tablet and stylus, and are retained over all other options in this frame, except for the SELECT BASIS option (10). Re-selection of the DRAW BOUNDARIES option automatically erases any previously drawn boundaries.

To draw a boundary, the user brings the attached stylus close to, but not touching the surface of the data tablet, activating a display screen cursor (a large plus sign), the position of which is dependent on the position of the stylus relative to the tablet surface. The user then fixes the initial point in the boundary by pressing the tip of the stylus against the tablet. A line segment is immediately drawn between the fixed point and the cursor such that the length and direction of the segment varies with movement of the cursor. The user terminates the segment and fixes its position by pressing the stylus against the tablet again. A new line segment is then drawn between the second fixed point and the cursor. This sequence continues until the user terminates the boundary through a keyboard response, or by completing six line segments.

The cursor disappears from the screen whenever the user takes the stylus out of proximity with the tablet. The adjustable line segment also disappears, but fixed line segments remain on the screen. Bringing the stylus back in proximity will restore the adjustable line, unless the user has terminated the boundary or the boundary has no fixed line segments. (Thus no boundary exists if the user deletes all of its fixed segments or removes the cursor after fixing only the initial point.)

Keyboard responses are ignored as long as the cursor is on the screen. When it is removed the user has four options: (1) Terminate the boundary (if a boundary is not terminated it is erased from the screen when the Escape option is selected), (2) Close Boundary terminates the boundary by drawing a line segment between the first and last fixed points in the boundary), (3) Delete Line (deletes the last fixed line segment from the screen. If that segment belongs to a terminated boundary, the resulting **boundary is not considered terminated**), and (4) Escape (erases any unterminated boundary and returns the user to the frame options).

After termination of the first boundary, all subsequent data tablet inputs are interpreted as belonging to a second boundary. After the second boundary is terminated all subsequent data tablet inputs are ignored and the only options open to the user are Delete line and Escape.

DIALOGUE:

System:

<DATA TABLE ACTIVE. <t>= terminate boundary, <c>= CLOSE BOUNDARY,
<d>= DELETE LINE, <e>= ESCAPE.

User:

The user can respond with one of the following inputs:

- a. t CR
- b. c CR
- c. d CR
- d. e CR

Option (a) terminates the boundary; that is closes it to all further data tablet input. (b) draws a line segment between the first and last point of the boundary and terminates it. (c) deletes the last line segment from the screen and if it belongs to a terminated boundary opens the boundary to further data tablet input. (d) erases any unterminated boundary and returns the user to the frame options.

ERROR MESSAGES:

None

NEXT FRAME:

2SPACE

2SPACE

09-00-00

OPTION

9 - PARTITION

GENERAL DESCRIPTION:

This option performs a subdivision of a single data node into two or three subnodes. The user specifies the subclasses via the draw boundaries option. The logic used to determine subclass membership is the same used in the Distribution Tree scatter plot. For the subclasses defined, a new vector data node and covariance file are created. The vector data file associated with the node selected for subdivision is deleted.

DIALOGUE:

S1 System:

< TYPE IN PLOT SYMBOL FOR PARTITIONED CLASS >

User:

A CR, where A is a plot symbol in the current vector data tree.

S2 System:

(If only one boundary, skip to step 4)

< SELECT BOUNDARY WITH LIGHT PEN >

User:

Touches a boundary with the light pen but pen switch is not active.

S3 System:

< MARK SELECTED BOUNDARY WITH AN X >

User:

Activates light pen switch to select the marked boundary or repeats previous step to select another boundary.

S4 System:

< USE DIALS TO MOVE CURSOR TO CONVEX SIDE OF MARKED BOUNDARY,
THEN TYPE CR. >

23-09-01

User:

(Moves cursor using dials 1 and 2, then types CR)

For each region i designated by the threshold settings, the following sequence is executed.

S5 System:

Displays region number in appropriate area on screen.

< TYPE IN FIVE CHAR NODE NAME FOR DATA IN REGION i >

User:

AAAAA CR Where AAAAA is a five character node name for the subclass in region i. The fifth character will be used as the plot symbol.

S6 System:

< WAIT - CREATING SUBCLASSES >

User:

No response required

S7 System:

< STAT COMP >

User:

No response required.

ERROR MESSAGES:

< NO BOUNDARIES EXIST >

User has failed to draw any boundaries.

< I/O ERROR >

Data set could not be retrieved.

NEXT FRAME:

STRANL

23-09-03

SECTION 24

ZOOM OPTIONS

Frame Name: ZMOPTS

Call Sequence: 09-01

ONE SPACE HISTOGRAM ZOOM OPTIONS

GENERAL DESCRIPTION:

This frame is called as an option in the structure analysis and logic design one space histogram frames. The options in this frame allow the user to manipulate the range of data being plotted in order to get a better idea of the distribution of the vectors in the data set.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 FULL RANGE	24-00-01
01 DIAL RANGE	24-01-01
02 TYPE RANGE	24-02-01
03 TYPE BIN RANGE	24-03-01
04 Blank	
05 "	
06 "	
07 "	
08 "	
09 "	
10 "	
11 "	
12 "	
13 "	
14 "	
15 "	

ZMOPTS

09-00-00-04

OPTION

00 - FULL RANGE

GENERAL DESCRIPTION:

This option allows the user to select the full range of the data for the histograms. This option is normally used to restore the histograms to their original form after some other ZMOPTS option has altered them.

DIALOGUE:

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< FILE ACCESS ERROR >

The data set could not be retrieved.

NEXT FRAME:

The frame from which ZMOPTS was called (1SPACE, DFHIST, or DFHFSH).

OPTION

01 - DIAL RANGE

GENERAL DESCRIPTION:

This option allows the user to redefine the range of the histogram data by positioning two boundaries on the display. The boundaries are marked L1 and L2 and represent the new minimum and maximum values of the data. Only those vectors which fall between the two lines will be used in the subsequent histogram calculations. The option has an overall effect of magnifying an area of the histogram for a better picture of the distribution of vectors within that area.

DIALOGUE:

System:

(Displays L1 and L2)

< DIALS 1 AND 2 ACTIVE. TYPE <CR> TO FREEZE LINES AND PROCEED. >

User:

(After positioning L1 and L2 with the dials)

CR

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< ERROR: RANGE OF DATA=0 >

< FILE ACCESS ERROR >

Data set could not be retrieved.

NEXT FRAME:

The frame from which ZMOPTS was called (1SPACE, DFHIST, or DFSFSH).

ZMOPTS

09-00-00-04

OPTION

02 - TYPE RANGE

GENERAL DESCRIPTION:

This option allows the user to redefine the range of the histogram data by typing a new minimum and maximum value. Only those vectors which fall between those values will be used in the subsequent histogram calculation. The option has an overall effect of magnifying (or reducing) an area of the histogram for a better picture of the distribution of the vectors within that area.

DIALOGUE:

System:

< ENTER MINIMUM >

User:

E and CR (E is a number not to exceed 20 characters. It can be in exponential format).

System:

< ENTER MAXIMUM >

User:

E and CR

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< FORMAT ERROR. MINIMUM = ? >

The string of characters entered by the user for either the minimum or maximum could not be interpreted as a number.

24-02-01

< ERROR: RANGE OF DATA = 0 >

< FILE ACCESS ERROR >

Data set could not be retrieved.

NEXT FRAME:

The frame from which ZMOPTS was called (1SPACE, DFHIST, or DFHFSH).

24-02-02

OPTION

03 - TYPE BIN RANGE

GENERAL DESCRIPTION:

This option allows the user to redefine the range of the histogram data by selecting two bin numbers. Only those vectors which fall within those bins or the bins between them will be used in subsequent histogram calculations. The option has an overall effect of magnifying an area of the histogram for a better picture of the distribution of vectors within that area.

DIALOGUE:

System:

< RANGE COMPUTED FROM BINS. FIRST BIN=? >

User:

N and CR (N is the number of the first bin to be used).

System:

< LAST BIN=? >

User:

N and CR (N is the number of the last bin to be used).

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< ERROR: RANGE OF DATA=0 >

< FILE ACCESS ERROR >

Data set could not be retrieved.

NEXT FRAME:

The frame from which ZMOPTS was called (1SPACE, DFHIST, or DFHFHSH).

SECTION 25

MEASUREMENT EVALUATION FRAME

Frame Name: MEAEVL

Call Sequence: 09-01

MEASUREMENT EVALUATION FRAME

GENERAL DESCRIPTION:

This frame allows the user to select a metric that will evaluate in a sub-optimal way the discriminatory powers of the features in the selected data set. Before executing options 00, 01, a data set must be selected.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 DISCRIM MEASURE	25-00-01
01 PROB OF CONFUS	25-01-01
02 Blank	
03 "	
04 "	
05 "	
06 "	
07 "	
08 "	
09 "	
10 SELECT DATA SET	8-13-01
11 LIST TREES	2-04-01
12 DRAW TREE	2-05-01
13 RET OLPARS FRM	20-1
14 RET INIT FRM	2-1
15 HARDCOPY	

MEAEVL

09-01

OPTION

00 - DISCRIM MEASURE

GENERAL DESCRIPTION:

This option computes the discriminant measure for the current data set. This measure indicates the discriminatory powers of the features used in the data set.

After the computation the frame "DMFRM" will be called.

DIALOGUE:

System:

< COMPUTATION IN PROGRESS >

< M < I,J > IN PROGRESS >

< M < I > IN PROGRESS >

< M IN PROGRESS >

These messages indicate different stages in the computation.

Since the computation will take time this will indicate that the computation is still in progress. Go to DMEVAL FRAME.

ERROR MESSAGE:

< ERROR >

Data set not selected, go to select data set option.

OPTION

01 - PROB OF CONFUS

GENERAL DESCRIPTION:

This option initializes parameters needed in the computation of the probability of confusion for the current data set. This measure indicates the discriminatory power of the features used in creating the data set. (See Vol I for details).

DIALOGUE:

System:

< T FOR 3 SIGMA, F FOR FULL RANGE, E FOR ESCAPE >

User:

"T" "CR" is typed through the VG keyboard to indicate that the mean + or - 3 sigma of the data set is to be used as the acceptable maximum and minimum range of the data in computing the probability of confusion.

"F" "CR" is typed to indicate that the maximum and minimum of the data set are to be used as the acceptable range of the data in computing the probability of confusion.

"E" "CR" is used to escape and return to MEAEVL FRAME.

System:

Lists on the VG display screen parameters necessary for the computation of the probability of confusion. This includes the acceptable maximum and minimum values of the data, and the # of bins.

If the data set has a dimensionality of greater than 25, only the parameters associated with the first 25 dimensions are displayed. This is because of flicker problems with the display.

ERROR MESSAGE:

<FILE ERROR >

Data set not selected.

SECTION 26

DISCRIMINANT MEASURE EVALUATION FRAME

Frame Name: DMFRM

Call Sequence: 09-01-00

DISCRIMINANT MEASURE

GENERAL DESCRIPTION:

This frame allows the user to display and select features according to their discriminatory powers using discriminant measure as a matrix.

Each display created in this frame contains an information box indicating the following:

- (a) that discriminant measure was used as the matrix.
- (b) the data tree that is being evaluated.
- (c) Least # of vectors contained in a class belonging to the current data tree.
- (d) a title indicating what is being displayed.

<u>MENU</u>	<u>DESCRIPTION ON PAGE</u>
00 - RANK OVERALL	26-00-01
01 - SEL CLASS/RANK	26-01-01
02 - SEL PAIR/RANK	26-02-01
03 - SEL MEA/RANK CLS	26-03-01
04 - SEL MEA/RANK PR	26-04-01
05 - UNION BEST CLASS	26-05-01
06 - UNION BEST PAIR	26-06-01
07 - SELECT CUTOFF	26-07-01
08 - SELECT ANY MEA	26-08-01
09 - CREATE TREE	26-09-01
10 - PRINT DISPLAY	26-10-01
11 - Blank	
12 - RET MEA EVAL	25-1
13 - RET OLPARS FRM	20-1
14 - RET INIT FRM	2-1
15 - Blank	

DMFRM

09-01-00

OPTION

00 - RANK OVERALL

GENERAL DESCRIPTION:

This option rank orders the dimensions in the current data set according to their overall discriminatory ability.

DIALOGUE

System:

Lists on the VG screen the dimension numbers in rank order of their discriminatory ability. Also displayed with each dimension is the following information:

- (a) overall figure of merit,
- (b) the class best separated from all other classes in the data set and
- (c) the pair of classes best separated by the dimension.

ERROR MESSAGES:

<FILE ERROR >

System I/O error, check hardware.

DMFRM

09-01-00

OPTION

01 - SEL CLASS/RANK

GENERAL DESCRIPTION:

This option rank orders the dimensions in the current data set according to their ability to discriminate a selected class from all of the other classes.

DIALOGUE:

System:

Draws on the VG screen the current data tree.

< CLASS SYMBOL >

User:

The user types in the last character of the class name.

This class is to be used in the evaluation.

System:

Displays on the VG screen the dimensions in order of their discrimination ability. Also displayed with each dimension is its figure of merit for separating the selected class from all other classes in the data set.

ERROR MESSAGE:

< FILE ERROR >

User did not type in proper class symbol.

26-01-01

DMFRM

09-01-00

OPTION

02 - SEL PAIR/RANK

GENERAL DESCRIPTION:

This option rank orders the dimensions in the current data set according to their ability to discriminate between two selected classes.

DIALOGUE:

System:

Draws on VG screen the current data tree

< FIRST CLASS SYMBOL >

User:

The user types in the last character of the class name.

This class is one of the classes used in the pairwise feature evaluation.

System:

< SECOND CLASS SYMBOL >

User:

The user types in the last character of a class name. This character must be different from the first character typed in. The class selected is the second class used in the pairwise feature evaluation.

System:

Displays on VG screen the dimension numbers in order of their discriminatory powers for separating the two selected classes. Also displays with each dimension its pairwise figure of merit.

26-02-01

ERROR MESSAGE:

< FILE ERROR >

User did not type in proper class symbols.

DMFRM

09-01-C0

OPTION

03 - SEL MEA/RANK CLS

GENERAL DESCRIPTION:

This option indicates which classes are best separated from all other classes in the data set for a selected dimension.

DIALOGUE:

System:

< FEATURE NUM >

User:

Types in dimension that the evaluation is to be performed on (Integer "CR"). If the input number is greater than the dimensionality of the data set, the system will ask again.

System:

Displays on the VG screen, in order of their separability, the classes of the current data set using the selected dimension. Also displayed with each class is its figure of merit.

ERROR MESSAGE:

< FILE ERROR >

System I/O error, check hardware.

DMFRM

09-01-00

OPTION

04 - SEL MEA/RANK PR

GENERAL DESCRIPTION:

This option displays the ranking of pairs of classes which are best discriminated by a selected dimension.

DIALOGUE:

System:

< FEATURE NUM >

User:

Types in dimension on which evaluation is to be conducted. If the input number is greater than the dimensionality of the data set, the system will ask again.

System:

Displays on VG screen in order of their separability, pairs of classes using the selected dimension. Also displayed with each pair of classes is its figure of merit.

ERROR MESSAGE:

< FILE ERROR >

System I/O error, check hardware.

DMFRM

09-01-00

OPTION

05 - UNION BEST CLASS

GENERAL DESCRIPTION:

This option automatically selects for each class in the data set the dimension that best separates the class from all other classes.

The dimensions selected through this option can be used to define the dimensions for a reduced feature tree (see CREATE TREE).

DIALOGUE:

System:

System will automatically select dimensions for create tree option. If the present display contains all of the dimensions in the data set, the selected dimensions will have a star (*) next to their number.

ERROR MESSAGE:

None

26-05-01

DMFRM

09-01-00

OPTION

06 - UNION BEST PAIR

GENERAL DESCRIPTION:

This option automatically selects for each pair of classes in the data set the dimensions that best separate the two classes.

The dimensions selected through this option can be used to define the dimensions for a reduced measurement tree (See CREAT TREE).

DIALOGUE:

System will automatically select appropriate dimensions for the create tree option. If the present display contains all of the dimensions in the data set, the selected dimension will have a star (*) next to its dimension number.

ERROR MESSAGE:

None

DMFRM

09-01-00

OPTION

07 - SELECT CUTOFF

GENERAL DESCRIPTION:

For those displays on the VG that display all of the dimensions, this option is operational. Its purpose is to automatically select all dimensions displayed above a selected dimension. The selected dimensions can be used to create a reduced measurement tree (see CREATE TREE).

DIALOGUE:

System:

If the current display contains all of the dimensions
< FEATURE NUM. FOR CUTOFF >
Else exit.

User:

Type in dimension number such that all of the dimensions
displayed above the selected number are to be selected for a
reduced measurement tree (Integer "CR").

System:

System will indicate selection by placing a star (*) next to the
selected dimension numbers.

ERROR MESSAGE:

None

26-07-01

DMFRM

09-01-00

OPTION

08 - SELECT ANY MEA

GENERAL DESCRIPTION:

This option permits the user to select or unselect any dimension. The selected dimensions can be used to create a reduced measurement tree. (See CREATE TREE).

DIALOGUE:

System:

System checks to see if the current VG display contains all of the dimensions. If not, go to S1; otherwise,

< LIGHT PEN ACTIVE, TYPE KB FOR KEYBOARD INPUT, < CR > TO ESCAPE >

User:

"KB" "CR" Go to S1

"CR" exit option

User may select any dimension by moving the system-generated printer, using the light pen, to the proper dimension. The user then touches the light pen switch to select. To unselect a dimension, proceed as above to a selected dimension. Each selected dimension is indicated by a star (*) next to its number.

S1: System:

< SELECT FEATURE NUM >

User:

User types in dimension number (Integer "CR") that is to be selected. If user types in "Ø" "CR" exit. All dimensions selected will have a star (*) next to its dimension number if the display is appropriate.

26-08-01

ERROR MESSAGE:

None

26-08-02

DMFRM

09-01-00

OPTION

09 - CREATE TREE

GENERAL DESCRIPTION:

This option creates a tree having selected dimensions of the current data set. The selection of dimensions for this reduced measurement tree is done by invoking options 05, 06, 07, 08.

DIALOGUE:

System:

< 6 CHARACTER TREE NAME >

User:

Type in a 6 character name "CR" for the tree being created.

System:

< TREE IN PROGRESS >

System will create a tree from the current data set having those dimensions which were selected by other options. The system will also print for each dimension in the new tree its corresponding position in the old tree.

ERROR MESSAGE:

< NO FEATURES SELECTED >

No dimensions have been selected; go to select feature option.

< FILE ERROR >

Typed in new tree already exists.

26-09-01

DMFRM

09-01-00

OPTION

10 - PRINT DISPLAY

GENERAL DESCRIPTION:

This option prints on the line printer the information displayed on the VG display screen.

DIALOGUE:

System:

Prints information on the line printer.

ERROR MESSAGE:

None

If printer does not print, check to see if it is on-line.

26-10-01

SECTION 27

PROBABILITY OF CONFUSION INITIALIZATION FRAME

Frame Name: PCIFRM

Call Sequence: 09-01-01

PROBABILITY OF CONFUSION INITIALIZATION FRAME

GENERAL DESCRIPTION:

This frame gives the user the ability to display and change the parameters used in computing the probability of confusion. (See Vol. 1 of this report for details).

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 CHANGE RANGE	27-00-01
01 CHANGE NUM BINS	27-01-01
02 DISPLAY RANGES	27-02-01
03 NEXT PAGE	27-03-01
04 CONTINUE	27-04-01
05 Blank	
06 "	
07 "	
08 "	
08 "	
10 "	
11 "	
12 RET MEA EVAL	25-1
13 RET OLPARS FRM	20-1
14 RET INIT FRM	2-1
15 Blank	

OPTION

00 - CHANGE RANGE

GENERAL DESCRIPTION:

This option gives the user the ability to change the acceptable maximum and minimum range parameters used in the computation of probability of confusion. The two possible parameter settings are the full range of the data or the mean + or - 3 sigma of the data. (See Vol. 1 of this report for more details).

DIALOGUE:

System:

< T FOR 3 SIGMA, F FOR FULL RANGE, E FOR ESCAPE >

User:

"T" "CR" is typed in through the keyboard to indicate that the mean + or - 3 sigma is to be used as the acceptable maximum and minimum of the data in computing probability of confusion.

"F" "CR" is typed through the keyboard to indicate that the full range of the data will be used in the computation of the probability of confusion.

"E" "CR" used to escape, no change is made in the parameters.

System:

Lists on the VG display screen, the parameters associated with the first 25 or less dimensions of the data set. These parameters, which are used in the computation of the probability of confusion, include number of bins, and the acceptable maximum and minimum for each dimension in the data set.

ERROR MESSAGE:

<FILE ERROR >

System I/O error, check hardware.

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THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM --ETC(U)
SEP 76 P K SANYAL, C BERSTER, T MCGIBBON F30602-72-C-0193
PAR-76-6 RADC-TR-76-224-VOL-2 NL

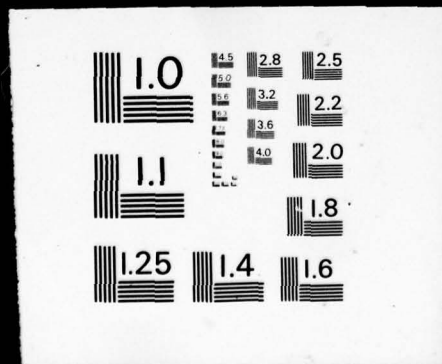
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PCIFRM

09-01-01

OPTION

01 - CHANGE NUM BINS

GENERAL DESCRIPTION:

This option gives the user the ability to change the number of bins for each dimension in the current data set. This number is used to compute the histograms in Probability of Confusion. The maximum number of bins is 100.

DIALOGUE:

System:

<FEATURE NUM., <CR > TO EXIT >

User:

Input dimension number (Integer "CR") through the keyboard to indicate which bin parameter is to be changed.

"CR" is typed to exit from routine.

NOTE: If the dimension number typed in exceeds the dimensionality of the data set, the system will ask again.

System:

< # OF BINS FOR FEATURE, 100 MAX >

User:

Type in the number of bins required (Integer "CR"). If this number exceeds 100 the system will ask again.

ERROR MESSAGE:

None

27-01-01

PCIFRM

09-01-01

OPTION

02 - DISPLAY RANGES

GENERAL DESCRIPTION:

This option displays on the VG screen parameters used in computing the probability of confusion for at most 25 dimensions of the current data set.

The parameters displayed include the feature number, # of bins, interval size of bins, acceptable maximum and minimum ranges, and the range of the data. (See Vol. 1 of this report for details).

DIALOGUE:

System:

Displays on VG screen the computation parameters for at most 25 dimensions of the current data set.

ERROR MESSAGE:

None

27-02-01

OPTION

03 - NEXT PAGE

GENERAL DESCRIPTION:

This option is the same as Display Ranges. The only difference is when the current data set has more than 25 dimensions. Each time this option is called the parameters associated with sequential groups of 25 dimensions are displayed until the last set of parameters are displayed. The system at this point will start over again beginning with the first 25 dimensions.

DIALOGUE:

System:

Display parameters associated with a set of 25 dimensions.

See DISPLAY RANGE for details.

ERROR MESSAGE:

None

PCIFRM

09-01-01

OPTION

04 - CONTINUE

GENERAL DESCRIPTION:

This option computes the Probability of Confusion for the current data set. This measure indicates the discriminatory powers of the features used in creating the data set.

After the computation the frame "PCFRM" will be called.

DIALOGUE:

< COMPUTATION IN PROGRESS >

< M < I,J > IN PROGRESS >

< M < I > IN PROGRESS >

< M IN PROGRESS >

These messages indicate different stages in the computation.

Since the computation will take time to complete, these messages will indicate that the computation is still in progress.

Go to frame "PCFRM".

ERROR MESSAGE:

< ERROR >

System I/O error, check hardware.

27-04-01

SECTION 28

PROBABILITY OF CONFUSION EVALUATION FRAME

Frame Name: PCFRM

Call Sequence: 09-01-01-05

PROBABILITY OF CONFUSION EVALUATION FRAME

GENERAL DESCRIPTION:

This frame allows the user to display and select features according to their discriminatory powers using Probability of Confusion as a metric.

Each display created in this frame contains an information box indicating the following:

- (a) that Probability of Confusion was used as the metric.
- (b) the data tree that is being evaluated.
- (c) LPAST # of vectors contained in a class belonging to the current data tree.
- (d) a title indicating what is being displayed.

<u>OPTIONS</u>	<u>DESCRIPTION</u>
00 RANK OVERALL	28-00-01
01 SEL CLASS/RANK	28-01-01
02 SEL PAIR/RANK	28-02-01
03 SEL MEA/RANK CLS	28-03-01
04 SEL MEA/RANK PR	28-04-01
05 UNION BEST CLASS	28-05-01
06 UNION BEST PAIR	28-06-01
07 SELECT CUTOFF	28-07-01
08 SELECT ANY MEA	28-08-01
09 CREATE TREE	28-09-01
10 PRINT DISPLAY	28-10-01
11 RET PROB CONF	27-1
12 RET MEA EVAL	25-1
13 RET OLPARS FRM	20-1
14 RET INIT FRM	2-1
15 Blank	

PCFRM

09-01-01-05

OPTION

00 - RANK OVERALL

GENERAL DESCRIPTION:

This option rank orders the dimensions in the current data set according to their overall discriminatory ability.

DIALOGUE:

System:

Lists on the VG screen the dimension numbers in rank order of their discriminatory ability. Also displayed with each dimension is the following information:

- (a) overall figure of merit
- (b) the class best separated from all other classes in the data set, and
- (c) the pair of classes best separated by the dimension.

ERROR MESSAGE:

< FILE ERROR >

System I/O error, check hardware.

OPTION

01 - SEL CLASS/RANK

GENERAL DESCRIPTION:

This option rank orders the dimensions in the current data set according to their ability to discriminate a selected class from all of the other classes.

DIALOGUE:

System:

Draws on the VG screen the current data tree.

< CLASS SYMBOL >

User:

The user types in the last character of the class name.

The class is to be used in the evaluation.

System:

Display on the VG screen the dimensions in order of their discrimination ability. Also displayed with each dimension is its figure of merit for separating the selected class from all other classes in the data set.

ERROR MESSAGE:

< FILE ERROR >

User did not type in proper class symbol.

OPTION

02 - SEL PAIR/RANK

GENERAL DESCRIPTION:

This option rank orders the dimensions in the current data set according to their ability to discriminate between two selected classes.

DIALOGUE:

System:

Draws on VG screen the current data tree.

< FIRST CLASS SYMBOL >

User:

The user types in the last character of the class name. This class is one of the classes used in the pairwise feature evaluation.

System:

< SECOND CLASS SYMBOL >

User:

The user types in the last character of a class name. This character must be different from the first character typed in. The class selected is the second class used in the pairwise feature evaluation.

System:

Displays on VG screen, the dimension numbers in order of their discriminatory powers for separating the two selected classes. Also displays with each dimension its pairwise figure of merit.

ERROR MESSAGE:

FILE ERROR

User did not type in proper class symbols.

PCFRM

09-01-01-05

OPTION

03 - SEL MEA/RANK CLS

GENERAL DESCRIPTION:

This option indicates which classes are best separated from all other classes in the data set for a selected dimension.

DIALOGUE:

System:

< FEATURE NUM >

User:

Type in dimension that the evaluation is to be performed on (Integer "CR"). If the input number is greater than the dimensionality of the data set, the system will ask again.

System:

Displays on the VG screen, in order of their separability, the classes of the current data set using the selected dimension. Also displayed with each class is its figure of merit.

ERROR MESSAGE:

< FILE ERROR >

System I/O error. Check hardware.

PCFRM

09-01-01-05

OPTION

04 - SEL MEA/RANK PR

GENERAL DESCRIPTION:

This option displays the ranking of pairs of classes which are best discriminated by a selected dimension.

DIALOGUE:

System:

< FEATURE NUM >

User:

Type in dimension on which evaluation is to be conducted. If input number is greater than the dimensionality of the data set, the system will ask again.

System:

Displays on VG screen, in order of their separability, pairs of classes using the selected dimension. Also displayed with each pair of classes is its figure of merit.

ERROR MESSAGE:

< FILE ERROR >

System I/O error, check hardware.

PCFRM

09-01-01-05

OPTION

05 - UNION BEST CLASS

GENERAL DESCRIPTION:

This option automatically selects for each class in the data set the dimension that best separates the class from all other classes.

The dimensions selected through this option can be used to define the dimensions for a reduced feature tree (see CREATE TREE).

DIALOGUE:

System:

System will automatically select dimensions for create tree option. If the present display contains all of the dimensions in the data set, the selected dimensions will have a star (*) next to their number.

ERROR MESSAGE:

None

28-05-01

PCFRM

09-01-01-05

OPTION

06 - UNION BEST PAIR

GENERAL DESCRIPTION

This option automatically selects for each pair of classes in the data set the dimension that best separates the two classes.

The dimensions selected through this option can be used to define the dimensions for a reduced measurement tree (see CREATE TREE).

DIALOGUE:

System:

System will automatically select appropriate dimensions for the create tree option. If the present display contains all of the dimensions in the data set, the selected dimensions will have a star (*) next to their dimension number.

ERROR MESSAGE:

None

28-06-01

OPTION

07 - SELECT CUTOFF

GENERAL DESCRIPTION:

For those displays on the VG that display all of the dimensions, this option is operational. Its purpose is to automatically select all dimensions displayed above a selected dimension. The selected dimensions can be used to create a reduced measurement tree (see CREATE TREE).

DIALOGUE:

System:

If current display contains all of the dimensions

< FEATURE NUM. FOR CUTOFF >

Else exit.

User:

Type in dimension number such that all of the dimensions displayed above the selected number are to be selected for a reduced measurement tree. (Integer "CR").

System:

System will indicate selection by placing a star (*) next to the selected dimension numbers.

ERROR MESSAGE:

None

OPTION

08 - SELECT ANY MEA

GENERAL DESCRIPTION:

This option permits the user to select or unselect any dimension. The selected dimensions can be used to create a reduced measurement tree. (See CREATE TREE)

DIALOGUE:

System:

System checks to see if the current VG display contains all of the dimensions. If not, go to S1; otherwise

< LIGHT PEN ACTIVE, TYPE KB FOR KEYBOARD INPUT, < CR > TO ESCAPE >

User:

"KB" "CR" Go to S1.

"CR" Exit option

User may select any dimension by moving the system-generated pointer, using the light pen, to the proper dimension. The user then touches the light pen switch to select. To unselect a dimension proceed as above to a selected dimension. All selected dimensions are indicated by a star (*) next to their number.

S1 System:

< SELECT FEATURE NUM >

User:

User types in dimension number (Integer "CR") that is to be selected. If user types in "Ø" "CR" exit. All dimensions selected will have a star (*) next to their dimension number if the display is appropriate.

ERROR MESSAGE:

None

28-08-02

PCFRM

09-01-01-05

OPTION

09 - CREATE TREE

GENERAL DESCRIPTION:

This option creates a tree having selected dimensions of the current data set. The selection of dimensions for this reduced measurement tree is done by invoking options 05, 06, 07, 08.

DIALOGUE:

System:

< 6 CHARACTER TREE NAME >

User:

Type in a 6 character name "CR" for the tree being created.

System:

< TREE IN PROGRESS >

System will create a tree from the current data set having those dimensions which were selected by other options. The system will also print for each dimension in the new tree its corresponding position in the old tree.

ERROR MESSAGE:

< NO FEATURES SELECTED >

No dimensions have been selected. Go to select feature option.

< FILE ERROR >

Typed in new tree already exists.

28-09-01

PCFRM

09-01-01-05

OPTION

10 - PRINT DISPLAY

GENERAL DESCRIPTION:

This option prints on the line printer the information displayed on the VG display screen.

DIALOGUE:

System:

Prints information on the line printer.

ERROR MESSAGE:

None

If printer does not print, check to see if it is on-line.

28-10-01

SECTION 29

TRANSFORMATION FRAME

Frame Name: TRNFRM

Call Sequence: 09-02

TRNFRM

09-02

TRANSFORMATIONS INITIAL FRAME

GENERAL DESCRIPTION:

OPTIONS

DESCRIPTION ON PAGE

00	EIGENVECTORS	Not Implemented
01	NORMALIZATION	Not Implemented
02	MEA REDUCTION	Not Implemented
03	Blank	
04	"	
05	"	
06	"	
07	"	
08	"	
09	"	
10	SELECT DATA SET	8-13-01
11	LIST TREES	2-04-01
12	DRAW TREE	2-05-01
13	RET OLPARS FRM	20-1
14	RET INIT FRM	2-1
15	HARDCOPY	

SECTION 30

DISTRIBUTION FREE LOGIC DESIGN FRAME

Frame Name: LOGDES

Call Sequence: 09-03

LOGDES

09-03

LOGIC DESIGN

GENERAL DESCRIPTION:

This is the initial frame for the distribution-free logic design functions under OLPARS.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - CREATE LOGIC	31-1
01 - EVALUATE LOGIC	34-1
02 - PAIRWISE MOD	30-02-01
03 - CREATE BOOL REJ	30-03-01
04 - CHG APRIORI PROB	30-04-01
05 - DRAW LOG TREE	30-05-01
06 - DELETE LOG TREE	30-06-01
07 - DELETE LOG NODE	30-07-01
08 - LIST LOG TREES	30-08-01
09 - SELECT LOG TREE	30-09-01
10 - PRINT LOG TREE	30-10-01
11 - SELECT DATA SET	8-13-01
12 - LIST TREES	2-04-01
13 - DRAW TREE	2-05-01
14 - RET OLPARS FRM	20-1
15 - HARDCOPY	

02 - PAIRWISE MOD

GENERAL DESCRIPTION:

This option allows the user to modify the logic at a pairwise logic node in the current logic tree. The user selects, from a list displayed on the VG, the pairwise logic node which is to be modified. This node becomes the current pairwise node for all pairwise modification options.

Prior to selecting this option, the user must have selected a current data set and a current logic tree.

DIALOGUE:

System:

< SELECT PAIRWISE LOGIC NODE >

User:

The user selects a pairwise logic node in the current logic tree.

System:

< WAIT >

ERROR MESSAGES:

< ILLEGAL NODE SELECTED >

Indicates the node selected was not a logic node.

< NODE SELECTED IS NOT PAIRWISE NODE >

< THERE ARE NO LOGIC NODES IN TREE >

< REJECT STRATEGY EXITS - ABORT >

Indicates Boolean reject strategy exists at the selected pairwise node. In this case, pairwise modification cannot be performed.

< LOGIC EXISTS BELOW SELECTED NODE >

All nodes subservient to the selected node must all be lowest nodes. All other errors indicate a hardware error occurred attempting to access a file.

NEXT FRAME:

PWMOD

03 - CREATE BOOL REJ

GENERAL DESCRIPTION:

This option allows the user to create Boolean reject strategy at a logic node in the current logic tree. The user selects a logic node and enters the reject strategy for the node. Whenever an overall evaluation is performed and a vector reaches a logic node containing Boolean reject strategy, the vector is tested against the reject strategy. If the results from the Boolean statement are true, the vector is allowed to be tested against the logic at the node; otherwise, the vector is immediately rejected.

Prior to selecting this option, the user must have selected a current logic tree.

The Boolean statement consists of the combinations of measurement variables, constants, arithmetic operators, relational operators, and logical operations. Following is a discussion of each:

Measurement Variables:

A measurement variable is denoted by the letter "M" (upper or lower case) followed immediately by an integer number. The integer specifies which measurement in the vector is to apply. For example:

M2 denotes the second measurement
m10 denotes the tenth measurement

The integer value must appear immediately after the "M" without embedded blanks, otherwise an illegal measurement or constant error will occur. The measurement number specified must be less than or equal to the dimension of the vector and greater than or equal to one, otherwise an error occurs.

Constants:

All constants are floating point positive values. They are denoted by a sequence of numerals and optionally, a decimal point. Embedded blanks are illegal. For example:

10 ten
100. one hundred
.1 one tenth

Arithmetic Operators:

Arithmetic operators are used to combine measurement variables and constants to form arithmetic expressions. Following is a list of arithmetic operators and their definition:

* multiplication
 / division
 + addition
 - subtraction or negation

An arithmetic expression is formed by alternately combining measurement variables or constants and arithmetic operators. There must be one more measurement variable or constant than the number of arithmetic operators. For example:

- (1) $M1-3.0$ 3 will be subtracted from m1
- (2) $m2*2.0-m3$ m2 will be multiplied by 2 and m3 subtracted
- (3) $M1-m2/2$ m2 will be divided by 2 and the quantity subtracted from m1

Multiplication and division have a higher hierarchy than addition and subtraction and are performed first. Operators of the same hierarchy are performed from left to right as they appear in the expression. Parentheses may be used to alter the order of operation. Operations in the innermost set of parentheses will be performed first, the second innermost performed second, etc. The interpretation of the third example above could be changed by placing parentheses around the two measurement variables as follows:

$(M1-m2)/2$ m2 will be subtracted from m1 and the quantity divided by 2

An arithmetic expression does not necessarily have to contain an arithmetic operator. A measurement variable or constant alone is a valid arithmetic expression. For example:

M1
 9.4

However, if it is necessary to use the negative value of a variable or constant, the negation operator may be used. The negation operator must be preceded by a left parenthesis unless it is the first character in the statement. Since all parentheses must balance, the right parenthesis must also appear somewhere in the expression. For example:

- (1) -M1
- (2) -9.4
- (3) $m1*(-m2)$ m2 is negated before multiplying m1
- (4) $-m1*m2$ m1 is multiplied by m2 and the quantity negated

Note that in the examples above, the number of operators and variables are equal. Negation is the only case where this holds true. Actually, when the statement is interpreted, a zero constant is assumed on the left side of the negation operator.

Relational Operators:

Relational operators are used to form a logical expression from two arithmetic expressions. Since the result of Boolean logic is a logical expression, the statement must contain at least one relational operation. Following is a list of relational operators and their definition:

<	less than
>	greater than
=	equal to
<= or =<	less than or equal to
>= or =>	greater than or equal to
<> or ><	not equal to

In forming the last three relational operators, embedded blanks between the two symbols are illegal. Following are some examples of logical expressions:

```
m1 < m2
m1+5.0 <> m2
((m1+1.0)*m2 < m3)
```

Logical Operators:

Logical operators are used to combine logical expressions to produce the logical result of the Boolean statement. Following is a list of logical operators and their definitions:

V	logical or (capital letter v)
Λ	logical and

The order in which logical operators are performed is from left to right unless logical expressions are enclosed by parentheses. Following are examples of complete Boolean statements.

```
(m1+m2 < m3 V m1 < m4) Λ (m2 > 3.0 V 25. < (m1+m2)*(-M1))
m1 < 25 Λ (-m1*m2) < 100
m1 < m2
```

Parentheses are used to change the order in which arithmetic and logical operations are performed. All parentheses must balance, and parentheses within arithmetic and logical expressions must balance as well. For example:

```
m1 + (m2 < m3)
```

is an illegal statement because the parentheses form a logical expression and an arithmetic operator cannot combine an arithmetic and logical expression. Another example of misuse of parentheses is:

```
m2(m3Vm3 > 2.0)
```

Here, the logical OR operator is attempting to combine an arithmetic expression with a logical expression. In the above two illegal examples, if the parentheses were omitted, the statements would be perfectly legal.

The hierarchy of operation is as follows:

LEVEL	OPERATOR	TYPE
5	()	Parentheses
4	*/	Arithmetic
3	+ -	Arithmetic
2	> , < , =	Relational
	> = , = >	
	< = , = <	
	> < , < >	
1	V ^	Logical

Operations at a higher level will be performed before operations at a lower level. If two operations are at the same level, they will be performed as they appear in the statement, from left to right. Operations in parentheses will be performed first, starting with the innermost set of parentheses.

DIALOGUE:

System:

< ENTER LOGIC NODE NUMBER >

User:

The user enters the logic node number where reject strategy is to be created. If reject strategy already exists at the selected node, it will be displayed and the system responds:

System:

< REJECT STRATEGY EXISTS CHANGE IT? (Y) >

User:

The user enters a "Y" if he wishes to change the reject strategy.

System:

< ENTER BOOLEAN STATEMENT OR TO TERMINATE CHARACTER SET: *1+- <> =

^ V () Mm 123456789. >

User:

The user enters the Boolean statement.

ERROR MESSAGES:

< NOT LOGIC NODE >

Indicates the selected node was not a logic node.

< STATEMENT ERROR >

Indicates an error occurred in attempting to compile the Boolean statement. The user has entered an unacceptable Boolean statement. An error message will precede this error message and attempt to describe the error in more detail if possible.

< TOO MANY PARENTHESES >

Indicates the user entered more than 64 levels of parentheses.

< PARENTHESES DO NOT BALANCE >

Indicates a left or right parenthesis is missing.

< SYNTAX ERROR - ILLEGAL CHARACTER >

Indicates an unrecognizable character appears in the statement.

< ILLEGAL OPERATORS >

Indicates an illegal combination of relational operators appears in the statement.

< MEAS # EXCEEDS DIMENSION >

Indicates a measurement number has been entered that exceeds the dimension of the vector file.

< INCOMPLETE STATEMENT >

Indicates that another arithmetic or logical expression is necessary to complete the statement.

< SYNTAX ERROR - ILLEGAL MEASUREMENT >

Indicates a measurement number was less than one or greater than 255.

< ILLEGAL STATEMENT >

Indicates the user entered a generally unacceptable statement.

All other error messages indicate a hardware error occurred when attempting to perform the reported operation.

NEXT FRAME:

N/A

04 - CHG APRIORI PROB

GENERAL DESCRIPTION:

This option displays on the Vector General the class symbols and their respective apriori probabilities located in the logic file (data type 22) requested by the user. (<CR> results in the display of the current logic tree). The user has the option of setting all probabilities equal (probability = 1/number of classes) or changing the probability of any class symbol; in which case, the probabilities of all other classes will be adjusted proportionally. (Equation A) If the user sets all probabilities equal, the system will display the results and exit. If the user changes the probability of one class, the system displays the result and returns to ask the user if he has another change. If he does not, the system returns to ask the user for another logic file.

Equation A. For any user-selected class X

$$\frac{1-P_f(x)}{1-P_1(x)} \times P_1(c) = P_f(c)$$

where

$P_f(x)$	=	input probability for class x
$P_1(x)$	=	initial probability of class x (as displayed)
$P_1(c)$	=	the probability of every class in the file except class x (the selected class)
$P_f(c)$	=	The new (adjusted) probability of every class in the file except class x

DIALOGUE:

System:

< LOGIC FILE NAME < CR > FOR CURRENT LOGIC TREE >

User:

The user will respond with one of the following options

a. NAME CR

b. CR

where NAME is any 6 character logic tree name. The first option will cause the system to display the requested logic tree name (NAME). The second option will result in the display of the current logic tree. Each option results in the following.

System:

< IF YOU WISH ALL PROBABILITIES TO BE SET EQUAL, TYPE Y < Y=YES >>

User:

The user will respond with one of the following responses

a. Y CR

b. CR

where Y indicates an affirmative response. The first option results in all probabilities being set equal, the file redisplayed as such, and exit from the system. The second option will result in the following:

System:

< ENTER CLASS SYMBOL, PROBABILITY < CR > IF NO CHANGES >

User:

The user will respond with one of the following responses

a. C, P CR

b. CR

where C = any class symbol in the file

P = the new probability for class C, P must be 8 digits or less and $0 < P < 1$

The first option results in the change of probability for class C to P and a proportional change on the probabilities of all other

classes. The system will redisplay the logic file with the new probabilities and return to ask the user for another class symbol and probability. The second option will result in the system asking for another logic file name unless the user exercised the second option for the first system request and had the current logic tree displayed. In this case the system will exit.

ERROR MESSAGES:

<NAME DOES NOT EXIST >

Indicates that NAME, the input logic file name, does not exist on the system disk. The system returns to ask the user for another logic file name.

<NO CURRENT LOGIC TREE EXISTS >

Indicates that the current logic tree was deleted and does not exist on the system disk. The system exits.

<NO. OF CLASSES = 0 >

Indicates that the number of classes in the logic tree requested by the user = 0. The system returns to ask the user for another logic file name.

< ERROR IN FORMAT >

Indicates that the user used the wrong format when typing in the class symbol and new probability. The system returns and again asks the user for class symbol, probability.

<THIS CLASS SYMBOL DOESN'T EXIST>

Indicates that the class symbol requested by the user does not exist in the logic file that is displayed. The system returns to ask the user for another class symbol, probability.

<ERROR: NEW PROBABILITY MUST BE <1 AND > 0 >

Indicates that the new probability input by the user was not less than and greater than zero. The system returns and asks for another class symbol, probability.

<THE FILE HAS NOT BEEN UPDATED DUE TO AN ERROR >

Indicates that an error occurred while updating the current logic file onto the system disk. The system returns and asks the user for another logic file.

<AN ERROR HAS OCCURRED >

Indicates an error occurred in closing the current logic file.
The system exits.

05 ~ DRAW LOG TREE

GENERAL DESCRIPTION:

This option draws the current logic tree on the Vector General display. The user has the option to display portions of the entire tree.

DIALOGUE:

System:

<NODE #, NUMBER OF LEVELS, S OR N (CR TO EXIT) >

User:

The user may display a portion of the current logic tree. He must enter the node number to begin displaying from, the number of levels to display, and either an S or N depending on whether or not the class symbols are to be displayed. Each entry must be separated by a comma. The user may omit entries; in which case, the default value will be used. The default values are:

0,100,S

A carriage return as the first character returns control to the system.

ERROR MESSAGES:

< LOGIC FILE ERROR >

Indicates a hardware error occurred attempting to access the logic tree file.

NEXT FRAME:

N/A

30-05-01

06 - DELETE LOG TREE

GENERAL DESCRIPTION:

This option first displays on the Vector General all logic trees located on the system disk. The user then requests the logic trees he wishes deleted. If the user selects the current logic tree, he will be warned he has done so and asked if he wants it deleted. Deletion of a logic tree includes data type 20, 21, and 22. Upon completion of the deletions, all remaining logic trees are displayed on the Vector General.

DIALOGUE:

System:

< LOGIC TREE NAME < CR > TO EXIT >

User:

The user will respond with one of the following options

- a. CR
- b. NAME CR

where NAME is any 6 character logic tree name. The first option will cause the system to exit. The second option will compare the input name to the current logic tree name. If not identical, the system will store the name for subsequent deletion and return to ask the user for another logic tree name. If identical, the system will respond:

System:

< NAME IS THE CURRENT LOGIC TREE. IF YOU WANT IT DELETED, TYPE Y < Y=YES >>

User:

The user will respond with one of the following inputs

- a. Y CR
- b. CR

where (Y) signifies an affirmative response. The first option will cause the system to store the input logic tree name for subsequent deletion and return to ask the user for another logic tree name. The second response will cause the system to disregard the input logic tree name and return to ask the user for another logic tree name.

ERROR MESSAGES:

< NAME IS NOT A LOGIC TREE >

Indicates that the input logic tree name does not exist on the system disk. The system will then return to ask the user for another logic tree name.

07 - DELETE LOG NODE

GENERAL DESCRIPTION:

This option allows the user to delete logic nodes in the current logic tree. The user selects a logic node and the logic is deleted and made a lowest node. All logic nodes below the selected node are also deleted. Prior to selecting this option, the user must have selected a current logic tree and current data set.

DIALOGUE:

System:

< ENTER NODE NUMBER >

User:

The user enters the node number of a logic node in the current logic tree.

System:

< WAIT >

ERROR MESSAGES:

< ILLEGAL NODE >

Indicates the node could not be found in the logic tree.

< ALREADY LOWEST NODE >

Indicates the selected node is a lowest node and not a logic node.

All other errors indicated a hardware error occurred attempting to access a file.

NEXT FRAME:

N/A

30-07-01

LOGDES

09-03

08 - LIST LOG TREES

GENERAL DESCRIPTION:

This option displays on the Vector General all active logic trees (data type 20) located on the disk pack (RP02). A maximum of 120 logic trees can be displayed (4 columns, 30 logic trees/column).

DIALOGUE:

System:

None

User:

None

ERROR MESSAGES:

< AN ERROR HAS OCCURRED >

Indicates an error occurred in attempting to access the directory table on the RP02. The program will exit after displaying the error message.

30-08-01

09 - SELECT LOG TREE

GENERAL DESCRIPTION:

This option allows the user to select a current logic tree. The user enters the name of the current logic tree. If the logic files associated with the current logic tree name do not exist in the file directory, a new logic tree is created. The class symbols associated with the new logic tree will consist of the sixth character of each class name in the current data set.

If the logic files associated with the current logic tree name do exist, the class symbols in the logic tree must correspond one for one with the class names of the current data set. The vectors in the current data set will be evaluated against the logic in the current logic tree.

DIALOGUE:

System:

< LOGIC TREE NAME >

User:

The user enters the current logic tree name.

System:

< WAIT >

ERROR MESSAGES:

< ILLEGAL DATA SET >

Indicates the current data set could not be retrieved.

< ILLEGAL LOGIC TREE NAME >

Indicates the user failed to enter a name for the current logic tree.

All other errors indicate a hardware error occurred attempting
to access a file.

NEXT FRAME:

N/A

10 - PRINT LOG TREE

GENERAL DESCRIPTION:

This option prints out on the line printer all the logic located in the logic file (data type 22) requested by the user. The system will handle the following types of logic:

- a. BOOLEAN
 - b. TWO SPACE
 - c. ONE SPACE
 - d. NEAREST MEAN
 - e. PAIRWISE
-
- I. Fisher
 - II. Arbitrary Vectors
 - III. Boolean
 - IV. Two Space

DIALOGUE:

System:

< ENTER DATE < DD-MON-YY >>

User:

The user will respond with one of the following options

a. DD-MON-YY CR

b. CR

where DD = 2 character date

MON = 3 character abbreviation of the month

YY = 2 character year

The first option will enable the system to date all pages that are printed out. The second option will leave the date blank on the printout. The use of either option will result in the following.

System:

< LOGIC FILE NAME < CR > TO EXIT >

User:

The user will respond with one of the following options

- a. NAME CR
- b. CR

where NAME is any 6 character logic file name. The first option will result in the printout of all logic in the logic file NAME. Upon completion of the printout, the system will return to ask the user for another work file name. The second option will cause the system to exit.

ERROR MESSAGES:

< NAME DOES NOT EXIST >

Indicates that the logic file requested by the user (NAME) does not exist on the system disk. The system will return and ask the user for another logic file name.

< AN ERROR HAS OCCURRED >

Indicates a hardware error while attempting to access or close a file on the system disk. The system will exit.

SECTION 31

CREATE LOGIC FRAME

Frame Name: CRELOG

Call Sequence: 09-03-00

CRELOG

09-03-00

CREATE LOGIC FRAME

GENERAL DESCRIPTION:

The options in this frame allow the projection of data along different dimensions or directions in the data space and draw boundary for creating logic. Also, Fisher Pairwise, Nearest Mean and Boolean Logic can be created.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 EIGENVECTORS	31-00-01
01 COORD VECTORS	31-01-01
02 Blank	
03 ARBITRARY VECs	31-03-01
04 FISHER PAIRWISE	31-04-01
05 NEAREST MEAN	31-05-01
06 BOOLEAN	31-06-01
07 DRAW LOG TREE	31-07-01
08 Blank	
09 "	
10 "	
11 "	
12 RET DF FRM	30-1
13 RET OLPARS FRM	20-1
14 RET INIT FRAME	2-1
15 HARDCOPY	

OPTION

00 - EIGENVECTORS

GENERAL DESCRIPTION:

This option computes the eigenvectors and eigenvalues of the covariance matrix of the current data set. The computation uses the Jacobi method and is limited to 70 dimensional data.

The eigenvalues are rank ordered and displayed on the Vector General. The user may then designate one or two eigenvalues. A histogram or scatter plot consisting of the projection of the current data set onto the eigenvectors corresponding to the selected eigenvalues will be produced. Designation of a single eigenvalue will cause a histogram to be produced. Designation of two eigenvalues will cause a scatter plot to be produced. The x-axis for the scatter plot will be the eigenvector corresponding to the first eigenvalue designated.

DIALOGUE:

System:

< TYPE IN VECTOR NUM OR CR TO TERMINATE >

User:

The user may respond with one of the following inputs:

- a. N CR CR
- b. N CR
N CR

where N is an integer number corresponding to the rank of the eigenvalue desired. The first option will cause a histogram to be produced and the second option will cause a scatter plot to be produced.

ERROR MESSAGES:

<DISC I/O ERROR >

Indicates an error occurred in attempting to access a file.

User should insure that a current data set is defined.

NEXT FRAME:

DFHIST - if histogram is selected

DFSCAT - if scatter plot is selected

OPTION

01 - COORD VECTORS

GENERAL DESCRIPTION:

This option displays the symbols C1 thru CN (where N is the number of dimensions in the current data set) on the Vector General console to represent the N measurements. The user may then designate one or two of the measurements. A histogram scatter plot of the current data set along the measurements selected will be produced. Designation of a single measurement will cause a frequency histogram to be produced. Designation of two measurements will cause a scatter plot to be produced. The x-axis for the scatter plot will correspond to the first measurement designated.

DIALOGUE:

System:

<TYPE IN VECTOR NUM OR CR TO TERMINATE >

User:

The user may respond with one of the following inputs:

- a. N CR CR
- b. N CR
N CR

where N is an integer number corresponding to the measurement desired. The first option will cause a histogram to be produced and the second option will cause a scatter plot to be produced.

ERROR MESSAGES:

<DISC I/O ERROR >

Indicates an error occurred in attempting to access a file.

User should insure a current data set is defined.

NEXT FRAME:

DFHIST

DFSCAT

31-01-02

OPTION

03 - ARBITRARY VECs

GENERAL DESCRIPTION:

This option allows the user to designate one or two vectors previously saved via the NAME & SAVE options in the 1SPACE and 2SPACE frames.

A list of the saved vector names along with a sequence number is displayed on the Vector General console. The user may then designate one or two of the sequence numbers. A histogram or scatter plot consisting of the projections of the current data set onto the vectors corresponding to the sequence numbers selected will be produced. Designation of a single number will cause a histogram to be produced. Designation of two numbers will cause a scatter plot to be produced. The x-axis for the scatter plot will be the vector corresponding to the first number designated.

DIALOGUE:

System:

< TYPE IN VECTOR NUM OR CR TO TERMINATE >

User:

The user may respond with one of the following inputs:

- a. N CR CR
- b. N CR
N CR

where N is an integer number corresponding to a sequence number being displayed. The first option will cause a histogram to be produced and the second option will cause a scatter plot to be produced.

ERROR MESSAGES:

< DISC I/O ERROR >

Indicates an error occurred in attempting to access a file.

User should insure a current data set is defined.

< NO FILE OR NDIM DOESN'T MATCH - TRY AGAIN >

Indicates the number input is not being displayed or that the vector selected does not have the same number of measurements as the current data set.

NEXT FRAME:

DFHIST - if histogram is selected

DFSCAT - if scatter plot is selected

04 - FISHER PAIRWISE

GENERAL DESCRIPTION:

This option allows the user to create Fisher pairwise logic at a lowest node in the current logic tree. The logic consists of two vectors and five thresholds for each class pair at the node. The first vector is the Fisher direction, the second vector is the vector orthogonal to the Fisher direction, which maximizes the same criterion as the Fisher Linear Discriminant. The five thresholds are computed based on the Fisher direction and the mean vectors of each class.

The selected node is divided into $N+1$ lowest nodes, where N is the number of classes at the selected node. Each class is assigned a node. The extra node is designated the reject class node (symbol *).

After the logic is created, the system performs an evaluation of the vectors at the selected node in each class against the logic. Each vector is projected on the Fisher direction and compared to the threshold values (initially one threshold is used). If the vector falls within the region assigned to a class (defined by the thresholds), the class receives a vote. If it falls within a reject region, the reject class receives a vote. After the votes are tallied for each class pair, the vector is assigned to the class receiving the most votes provided the vote count is greater than or equal to the user-supplied minimum vote count. Otherwise, the vector is assigned to the reject class. If two or more classes tie, the vector is assigned to the class with the greater a priori probability.

The result of the evaluation is a confusion matrix which may be printed on either the VG or line printer. A detailed listing of all misclassified vectors may also be requested.

Since the covariance matrix for each class is required to compute the Fisher direction and the mean vector is required to compute the thresholds, the user must select the data used to compute each covariance matrix and mean vector. He may select either all the data for each class in the current data set, or only the data for each class that reside at the selected logic node by means of previous logic evaluation.

Fisher pairwise logic is limited to 61 dimensional data. The user should also be aware that the second vector is never used in the evaluation. This vector is used only as a second projection vector under the PWMOD-DISCRIM PLANE option. The two initial vectors will produce the optimal discriminant plane scatter plot for the class pair. The vector is computed and saved only for convenience.

DIALOGUE:

System:

< SELECT LOGIC NODE >

User:

The user enters the logic node where pairwise logic is to be created.

System:

< ENTER 0-ALL CLASS DATA 1-CLASS DATA AT NODE >

User:

User selects data to use for computing covariance matrix.

He types:

0 - for all data vectors in the class

1 - for those vectors in the class residing at the selected
node through logic evaluation

System:

< WAIT -- CREATING FISHER LOGIC >

< ENTER MINIMUM VOTE COUNT RANGE 0 - n >

where n is the number of classes at the node minus one.

User:

User enters minimum vote count.

System:

< PAIRWISE EVALUATION IN PROGRESS >

Followed by:

< ENTER V-VG L-LINE PRINTER B-BOTH >

User:

User selects the device for the confusion matrix output. Legal responses are:

V - Vector General output

L - Line Printer output

B - Output on both the Vector General and Line Printer

If the Vector General has been selected for confusion matrix output and the matrix is too large to be displayed on the VG, the matrix will automatically be broken into several pages and each page will be displayed separately. Then the following system dialogue and user response will occur for each additional page.

System:

< (CR) FOR NEXT PAGE >

User:

User types a carriage return to view the next page of the confusion matrix.

After the entire confusion matrix is printed, the following dialogue occurs.

System:

< DETAILED ERROR LISTING? (Y) >

User:

The user types a "Y" to request a detailed listing of misclassified vectors.

ERROR MESSAGE

< ILLEGAL LOGIC FILE >

Indicates an error occurred in attempting to access the logic tree file. User should insure that a current logic tree is defined.

< ILLEGAL NODE >

Indicates the system attempted to access a non-existent logic node, or a hardware error occurred in the attempt to access a legal node.

< NOT LOWEST NODE >

Indicates the user selected a node which was not a lowest node. Logic may be created only at a lowest node.

< LESS THAN TWO CLASSES AT NODE >

There must be at least two class symbols assigned to a node in order to create pairwise logic.

< RETRIEVE NODE ERROR >

Indicates a hardware error in an attempt to retrieve a logic node.

< CLASS NAME AND SYSTEM MATCH ERROR >

Indicates a class symbol could not be associated with a class name in the data set.

< ERROR IN PARTIAL COVARIANCE >

Indicates a hardware error occurred while computing the covariance matrix.

< CREATE TEMP FILE ERROR >

Indicates an error occurred attempting to create a temporary file for storing the covariance file. Could occur due to insufficient disk space or hardware error.

< PUT ERROR >

Indicates hardware error when writing covariance file to disk.

< FISHER VECTORS ERROR >

Indicates an error occurred in the module FISODP which creates the Fisher vector for a class pair.

< ADD NODE ERROR >

Indicates an error occurred attempting to add a level of nodes to the logic tree. May be due to a hardware error or attempting to add nodes to a node which is not a lowest node.

< RETRIEVE NODE - ADPNOD >

Indicates a hardware error in an attempt to retrieve a logic node.

< DIMENSION ERROR >

Indicates dimension of the data set is greater than 61.

< ADD SYM ERROR >

Indicates an error occurred attempting to add symbols to the class symbol file. May be due to insufficient disk space or hardware error.

< UPDATE LOGIC TREE ERROR >

Indicates a hardware error occurred updating the logic tree file.

< LOGIC FILE ERROR >

Indicates an error occurred accessing the logic file. May be due to insufficient disk space or hardware error.

< CLASS NAMES ERROR >

Indicates a hardware error occurred retrieving the class names.

< OPEN CLASS FILE ERROR >

Indicates an error occurred opening a class data file. May be due to a hardware error or the file doesn't exist.

< REPLACE VECTOR ERROR >

Indicates a hardware error updating the class data file.

NEXT FRAME:

N/A

05 - NEAREST MEAN

GENERAL DESCRIPTION:

This option generates nearest mean vector logic based on various user-specified options. It also performs a partial evaluation using the logic and the data of design data set. The user may then accept the logic, select another nearest mean option, select another logic, or reject the logic.

DIALOGUE:

System:

- < DO YOU WISH >
- < 0 - SIMPLE NMV >
- < 1 - WEIGHTING VECTORS >
- < 2 - WEIGHTING MATRIX >
- < ENTER NUMBER OF OPTION >

User:

The user enters the number of the option he wishes. Option 0 allows the user to create simple nearest mean vector logic. Option 1 allows the user to select weighted nearest mean vector where the weights are the inverse of the class variance along each feature. Option 2 creates logic which is nearest mean vector weighted by the inverse of the covariance matrix (Mahalanobis distance).

If the user enters an illegal option number, the system responds by asking for the option to be reentered at which time the user should respond with correct option.

System:

< DO YOU WISH >
< 0 - REJECT BOUNDARY >
< 1 - REJECT BOUNDARY VALUE >
< 2 - NO REJECT STRATEGY >
< ENTER NUMBER OF OPTION >

User:

This allows the user to select a reject strategy. Option 0 is a subset of Option 1. Option 1 allows the user to select a reject boundary value for all classes or for each individual class. If this option is selected, the following questions would be asked:

System:

< ARE ALL REJECT VALUES TO BE EQUAL? >

User:

This warrants a "yes" or "no" response. If "yes", the reject values for all classes are to be equal. If "yes", the question <ENTER REJECT VALUE> is asked, at which time the user would respond with the numerical value to correspond to the reject value.

If "no", then for each class, the question

< ENTER REJECT VALUE FOR CLASS X(class symbol)

is asked, at which time the user would respond with the numerical value to correspond to the reject value for that class.

Option 0 assumes that the reject values for each class are to be equal and that the reject value is to be 0.0.

Option 2 implies that no reject strategy is to be applied to the logic.

System:

<ENTER 0 - ALL CLASS DATA, 1 - CLASS DATA AT NODE >

User:

The user should reply with the number of the option he wishes followed by a carriage return. What this question is asking is, while creating logic are we to (0) use all vectors of all classes at each logic node or (1) use only the vectors that fall at that logic node?

System:

The system then creates the logic and performs a partial evaluation to generate a confusion matrix. It then asks the user

<ENTER V-VG, L-LINE PRINTER, B-BOTH >

User:

The user responds either V, L, or B followed by a carriage return as to whether he wants the confusion matrix printed on the VG, Line Printer, or both VG and Line Printer respectively. If V was the response and confusion matrix is too large for the VG, the matrix is automatically broken up into pages. The first page of the matrix is put onto the VG. The system then responds

< (CR) FOR NEXT PAGE >

in which case the system puts up the next page of the confusion matrix when the user enters a carriage return.

System:

< DO YOU WISH A DETAILED ERROR LISTING? (Y) >

User:

This requires a "yes" or "no" response. If "no", all that is required is a carriage return. If "yes", a "Y" should be entered followed by carriage return.

System:

If "no" is the response, no action is taken.

If "yes", a detailed error listing of all misclassified and rejected vectors is printed on the line printer. In this listing, one will find the misclassified vector's id followed by the true class and the assigned class. Following this will be the distance to the true class and the distance to the assigned class.

If the vector was rejected, the id of the vector is given and the distance to the nearest class is given.

After this the system asks:

< DO YOU WANT TO >

< A - ACCEPT THIS LOGIC >

< R - REJECT THIS LOGIC >

< T - TRY ANOTHER NEAREST MEAN OPTION >

< ENTER LETTER OF OPTION >

User:

The user responds with the letter of the option he wishes followed by carriage return. If an incorrect letter is entered, the system

<OPENLF ERROR >

<CAN'T FIND LOGIC NODE IN LOGIC FILE >

<REPVEC ERROR >

<CLOSE (VECTOR) ERROR >

<CLASS SYMBOL 1 = CLASS >

<OPNFLU ERROR >

<GETVEC ERROR >

06 - BOOLEAN

GENERAL DESCRIPTION:

This option allows the user to create Boolean logic at a lowest node in the current logic tree. Prior to selecting this option, the user must have selected a current vector data set and logic tree. The user must select a lowest logic node in the logic tree where the Boolean logic is to be created. Since Boolean logic is a binary operation, the selected logic node will be automatically split into two nodes; the leftmost node corresponding to a true response from the Boolean logic statement, the rightmost node corresponding to a false response.

The user enters the Boolean statement (detailed below) and the vectors are evaluated against the logic at the node. The results are displayed on the VG. The user has the option of accepting or rejecting the logic. If accepted, he must specify the class symbols associated with a true response, and those with a false response. The logic is saved in the logic tree and control is returned to the system. If the logic is rejected, the user has the option of trying another Boolean statement or returning control to the system. The user may also request a list of misclassified vectors.

The Boolean statement consists of the combinations of measurement variables, constants, arithmetic operators, relational operators, and logical operators. Following is a discussion of each:

Measurement Variables:

A measurement variable is denoted by the letter "M" (upper or lower case) followed immediately by an integer number. The integer specifies which measurement in the vector is to apply. For example:

M2 denotes the second measurement
m10 denotes the tenth measurement

The integer value must appear immediately after the "M" without embedded blanks; otherwise an illegal measurement or constant error will occur. The measurement number specified must be less than or equal to the dimension of the vector and greater than or equal to one; otherwise an error occurs.

Constants:

All constants are floating point positive values. They are denoted by a sequence of numerals and, optionally, a decimal point. Embedded blanks are illegal. For example:

10 ten
100. one hundred
.1 one tenth

Arithmetic Operators:

Arithmetic operators are used to combine measurement variables and constants to form arithmetic expressions. Following is a list of arithmetic operators and their definition:

*	multiplication
/	division
+	addition
-	subtraction or negation

An arithmetic expression is formed by alternately combining measurement variables or constants and arithmetic operators. There must be one more measurement variable or constant than the number of arithmetic operators. For example:

- | | | |
|-----|-------------|---|
| (1) | $M1-3.0$ | 3 will be subtracted from m1 |
| (2) | $m2*2.0-m3$ | m2 will be multiplied by 2 and m3 subtracted |
| (3) | $M1-m2/2$ | m2 will be divided by 2 and the quantity subtracted from m1 |

Multiplication and division have a higher hierarchy than addition and subtraction and are performed first. Operators of the same hierarchy are performed from left to right as they appear in the expression. Parentheses may be used to alter the order of operation. Operations in the innermost set of parentheses will be performed first, the second innermost performed second, etc. The interpretation of the third example above could be changed by placing parentheses around the two measurement variables as follows:

$(M1-m2)/2$ m2 will be subtracted from m1 and the quantity divided by 2

An arithmetic expression does not necessarily have to contain an arithmetic operator. A measurement variable or constant alone is a valid arithmetic expression. For example:

M1
9.4

However, if it is necessary to use the negative value of a variable or constant, the negation operator may be used. The negation operator must be preceded by a left parenthesis unless it is the first character in the statement. Since all parentheses must balance, the right parenthesis must also appear somewhere in the expression. For example:

- | | | |
|-----|------------|---|
| (1) | -M1 | |
| (2) | -9.4 | |
| (3) | $m1*(-m2)$ | m2 is negated before multiplying m1 |
| (4) | $-m1*m2$ | m1 is multiplied by m2 and the quantity negated |

Note that in the examples above, the number of operators and variables are equal. Negation is the only case where this holds true. Actually, when the statement is interpreted, a zero constant is assumed on the left side of the negation operator.

Relational Operators:

Relational operators are used to form a logical expression from two arithmetic expressions. Since the result of Boolean logic is a logical expression, the statement must contain at least one relational operation. Following is a list of relational operators and their definition:

<	less than
>	greater than
=	equal to
<= or =<	less than or equal to
>= or =>	greater than or equal to
<> or ><	not equal to

In forming the last three relational operators, embedded blanks between the two symbols are illegal. Following are some examples of logical expressions:

```
m1 < m2
m1+5.0 <> m2
((m1+1.0)*m2 < m3)
```

Logical Operators:

Logical operators are used to combine logical expressions to produce the logical result of the Boolean statement. Following is a list of logical operators and their definitions:

V	logical or (capital letter v)
^	logical and

The order in which logical operators are performed is from left to right unless logical expressions are enclosed by parentheses. Following are examples of complete Boolean statements.

```
(m1+m2 < m3 V m1 < m4) ^ (m2 > 3.0 V 25. < (m1+m2)*(-M1))
m1 < 25 ^ (-m1*m2) < 100
m1 < m2
```

Parentheses are used to change the order in which arithmetic and logical operations are performed. All parentheses must balance, and parentheses within arithmetic and logical expressions must balance as well. For example:

```
m1 + (m2 < m3)
```

is an illegal statement because the parentheses form a logical expression and an arithmetic operator cannot combine an arithmetic and logical expression. Another example of misuse of parentheses is:

m2(m3Vm3 > 2.0)

Here the logical OR operator is attempting to combine an arithmetic expression with a logical expression. In the above two illegal examples, if the parentheses were omitted, the statements would be perfectly legal.

The hierarchy of operation is as follows:

LEVEL	OPERATOR	TYPE
5	()	Parentheses
4	*/	Arithmetic
3	+ -	Arithmetic
2	> , < , =	Relational
	> = , = >	
	< = , = <	
	< > , > <	
1	V ^	Logical

Operations at a higher level will be performed before operations at a lower level. If two operations are at the same level, they will be performed as they appear in the statement, from left to right. Operations in parentheses will be performed first, starting with the innermost set of parentheses.

DIALOGUE:

System:

< SELECT LOGIC NODE >

User:

The user enters the logic node number where Boolean logic is to be created.

System:

< ENTER BOOLEAN STATEMENT OR TO TERMINATE CHARACTER SET: */ + - <>
= ^ V () M m 123456789. >

User:

The user enters the Boolean statement. The user may enter the statement on successive lines. and each line is displayed on the

VG. Blanks between operators and variables are ignored, and a carriage return as the first character of the line terminates the Boolean statement.

System:

< HARDCOPY? (Y) >

User:

The user types a "Y" to request a hardcopy of the evaluation; otherwise types a carriage return.

System:

< A-ACCEPT R-REJECT T-TRY ANOTHER STATEMENT D-DETAILED LISTING >

User:

After the evaluation has been completed, the user types one of the following letters to indicate the next course of action:

A - indicates the logic is to be accepted and saved in the logic file and control returned to the system.

R - indicates the logic is to be rejected and control returned to the system.

T - indicates the logic is to be rejected and the user will enter another Boolean statement.

D - indicates the request for a detailed error listing of misclassified vectors.

If the user selected option A or D, and symbols have not been assigned to nodes, the system responds with the following:

System:

< ENTER SYMBOLS FOR TRUE RESPONSE >

User:

The user must enter the class symbols associated with a true response from the Boolean logic.

System:

< ENTER SYMBOLS FOR FALSE RESPONSE >

User:

The user must enter the class symbols associated with a false response from the Boolean logic.

If an error occurs in entering class symbols, the following message is printed and the symbols must be entered again.

System:

< ILLEGAL SYMBOL ENTRY TRY AGAIN >

To properly enter class symbols the user must satisfy the following conditions:

1. All symbols at the node must be assigned.
2. The user must type only those symbols associated with the logic node.
3. If the reject symbol (*) is assigned to either a true or false response, it must be the only symbol associated with the response; all other symbols must be assigned to the other response.

ERROR MESSAGES:

< ILLEGAL LOGIC TREE >

Indicates the current logic tree does not exist or a hardware error occurred attempting to access the file.

< ILLEGAL NODE >

Indicates the user attempted to create logic at a nonexistent node in the current logic tree.

< NOT LOWEST NODE >

Indicates the user attempted to create logic at a node other than a lowest node in the current logic tree.

< STATEMENT ERROR >

Indicates an error occurred in attempting to compile the Boolean statement. The user has entered an unacceptable Boolean statement. An error message will precede this error message and attempt to describe the error in more detail if possible.

< TOO MANY PARENTHESES >

Indicates the user entered more than 64 levels of parentheses.

< PARENTHESES DO NOT BALANCE >

Indicates a left or right parenthesis is missing.

< SYNTAX ERROR - ILLEGAL CHARACTER >

Indicates an unrecognizable character appears in the statement.

< ILLEGAL OPERATORS >

Indicates an illegal combination of relational operators appears in the statement.

< MEAS # EXCEEDS DIMENSION >

Indicates a measurement number has been entered that exceeds the dimension of the vector file.

< INCOMPLETE STATEMENT >

Indicates that another arithmetic or logical expression is necessary to complete the statement.

< SYNTAX ERROR - ILLEGAL MEASUREMENT >

Indicates a measurement number was less than one or greater than 255.

< ILLEGAL STATEMENT >

Indicates the user entered a generally unacceptable statement.

All other error messages indicate a hardware error occurred when attempting to perform the reported operation.

NEXT FRAME:

N/A

CRELOG

09-03-00

07 - DRAW LOG TREE

GENERAL DESCRIPTION:

This option draws the current logic tree on the Vector General display. The user has the option to display portions of the entire tree.

DIALOGUE:

System:

< NODE #, NUMBER OF LEVELS, S OR N (CR TO EXIT) >

User:

The user may display a portion of the current logic tree. He must enter the node number to begin displaying from, the number of levels to display, and either an S or N depending on whether or not the classs symbols are to be displayed. Each entry must be separated by a comma. The user may omit entries; in which case the default value will be used. The default values are:

0,100,S

A carriage return as the first character returns control to the system.

ERROR MESSAGES:

< LOGIC FILE ERROR >

Indicates a hardware error occurred attempting to access the logic tree file.

NEXT FRAME:

N/A

31-07-01

SECTION 32

HISTOGRAM PLOT FRAME

Frame Name: DFHIST

Call Sequence: 09-03-00-00

DISTRIBUTION FREE LOGIC DESIGN HISTOGRAM

GENERAL DESCRIPTION:

This frame accompanies the 1 space histogram plot under logic design. Its options deal primarily with manipulations of the basic plot. It includes an option to create and evaluate 1 space logic.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 SELECT CLASSES	32-00-01
01 CHNGE BIN PARAMS	32-01-01
02 CHNGE PAGE SIZE	32-02-01
03 DISP BIN COUNT	32-03-01
04 ZOOM OPTIONS	24-1
05 COMPARE CLASSES	32-05-01
06 LOCAL VERT SCL	32-06-01
07 GLOBAL VERT SCL	32-07-01
08 NEXT CLASS	32-08-01
09 NEXT PAGE	32-09-01
10 SET THRESHOLDS	32-10-01
11 EVALUATE	32-11-01
12 SELECT BASIS	22-13-01
13 RET CRELOG FRM	31-1
14 RET DF FRM	30-1
15 HARDCOPY	

OPTION

00 - SELECT CLASSES

GENERAL DESCRIPTION:

This option allows the user to select by name the histograms of any classes in the data set. A maximum of ten selections can be made with the light pen and then, viewing the display from bottom to top, the histograms of the chosen classes are presented to the user in the order of their selection. The normal order of the histograms can be restored by the CHNGE PGE SIZE option (02) or the NEXT PAGE option (09). The NEXT CLASS option (08) continues to function as described. All other options except for SELECT BASIS (13) maintain the selected order.

When the option is chosen the frame option menu is temporarily destroyed and replaced by a list of the current class (node) names. To select a class, the user moves the light pen over this list. A small arrow indicates which class name the light pen senses. When the arrow is positioned before the proper class, the user presses the light pen switch. A number from one to ten will appear next to the class name, indicating both that the class has been selected and the number of selections which have been made. Once ten selections have been made, further light pen activity is ignored.

The user responds with a carriage return at any time and the selected histograms will be displayed. If the user does not select any classes, the current display will not be affected.

DIALOGUE:

System:

< LIGHTPEN CLASSES (10 MAXIMUM). TYPE / TO RE-SELECT, ANYTHING ELSE =<CR>
TO PROCEED.>

User:

The user can respond with one of the following inputs:

- a. / CR
- b. X CR

Option (a) clears all the selection numbers so that the user can
reselect the classes. In option (b) X signifies that the input

is not important. Anything but (a) terminates the option.

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

DFHIST

09-03-00-00

OPTION

01 - CHANGE BIN PARAMETERS

GENERAL DESCRIPTION:

This option allows the user to change one of two scaling factors of the histogram plot: (1) the number of bins or (2) the size of a bin. The histogram will be completely recalculated on the basis of the user's input.

DIALOGUE:

System:

< SELECT OPTION: A=CHANGE # OF BINS, B=CHANGE BIN SIZE.>

User:

a. A and CR

b. B and CR

Option (a)

System:

< ENTER # OF BINS. MAXIMUM = 100.>

User:

N and CR (where N equals the new number of bins).

Option (b)

System:

< ENTER NEW BIN SIZE. >

User:

E and CR (E is a number not to exceed 20 characters. E can be in exponential format).

System:

< DO YOU WANT TO KEEP THE SAME # OF BINS? (Y=YES)>

32-01-01

User:

- a. Y and CR
- b. CR

System:

< NEW RANGE MUST BE COMPUTED. TYPE: A=KEEP SAME MINIMUM,
B=KEEP SAME MAXIMUM, C=KEEP SAME MIDPOINT >

User:

- a. A and CR
- b. B and CR
- c. C and CR

The range of the data is the product of the bin size and the number of bins. The range is expanded or decreased by (a) increasing or decreasing the maximum, (b) decreasing or increasing the minimum, or (c) decreasing the minimum and increasing the maximum or increasing the minimum and decreasing the maximum.

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< MAXIMUM=100, TRY AGAIN >

The user has selected too many bins).

< FORMAT ERROR, NEW BIN SIZE=? >

(The string of characters that the user typed could not be interpreted as a number.

< ERROR: RANGE OF DATA = \emptyset >

< FILE ACCESS ERROR >

(The data set could not be retrieved).

NEXT FRAME:

DFHIST

32-01-03

OPTION

02 - CHNGE PAGE SIZE

GENERAL DESCRIPTION:

This option allows the user to change the number of histograms displayed per page. The number of pages is set equal to the total number of classes divided by the number of histograms per page (plus 1 if there is a remainder) and the histograms for the current page or for page one, if the current page no longer exists, are then replotted. The new paging scheme is retained over all other options in the frame except the SELECT BASIS option (13).

Pages are originally defined after the select histogram option (see STRANL) and before the 1SPACE frame is displayed. At that time, the number of pages is set equal to the number of classes divided by ten (plus 1 if there is a remainder). Ten is the maximum number of histograms allowed per page. If there are fewer than ten classes, then there is only one page and the number of histograms per page is equal to the number of classes.

The number of histograms per page determines the size of the histograms. That is, as the number of histograms decreases, the lengths of the vertical lines which represent the bin counts increase. Note that (1) the scaling is dependent on the allotted number of histograms per page, not the number on the current page and (2) histograms which are plotted one per page are the same size as those plotted two per page.

DIALOGUE:

System:

< ENTER # OF LINE PER PAGE. MAXIMUM = 10.>

User:

N CR

where N is an integer from one to ten.

ERROR MESSAGES:

< MAXIMUM = 10. TRY AGAIN.>

User response must be less than or equal to ten. The system expects the user to respond again.

NEXT FRAME:

DFHIST

DFHIST

09-03-00 -00

OPTION

03 - DISP BIN COUNT

GENERAL DESCRIPTION:

This option displays the number of vectors of each class on the current page contained in any user selected bin. The user moves a small arrow across the top of the display by means of potentiometer or control dial 1. As the arrow moves from one bin to another, a message of the form BIN N, COUNT = C is displayed in the lower left hand corner of each histogram. N is the number of the bin to which the arrow is pointing and C is the number of vectors of the given class which are in that bin.

DIALOGUE:

System:

< DIAL 1 ACTIVE. TYPE CR TO ESCAPE. >

User:

CR

The user responds with a carriage return to terminate the option. The bin count messages disappear.

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

32-03-01

DFHIST

09-03-00 -00

OPTION

05 - COMPARE CLASSES

GENERAL DESCRIPTION:

This option allows the user to compare displayed classes by vertically moving the image of any selected histogram over the display space.

The user activates a class by passing the light pen with the switch pressed over the histogram on the display. Once a class is activated, a second image of the histogram appears on the screen and is moved vertically by use of potentiometer or control dial 1. The user deactivates a class by activating another or by terminating the option. The option is terminated with a keyboard response.

DIALOGUE:

System:

< ACTIVATE CLASS WITH LIGHT PEN. MOVE CLASS WITH CONTROL DIAL 1.

TYPE < CR> TO ESCAPE. >

User:

CR The user types CR to terminate the option.

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

32-05-01

DFHIST

09-03-00-00

OPTION

06 - LOCAL VERT SCL

GENERAL DESCRIPTION:

This option changes the scale of the histogram so that vertical scaling is class dependent. The maximum bin count in each class will be represented by a line that is the same length in every class, but which does not necessarily indicate that the bin counts are identical. All other bin counts will be plotted relative to the maximum bin count of the same class.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

32-06-01

DFHIST

09-03-00-00

OPTION

07 - GLOBAL VERT SCL

GENERAL DESCRIPTION:

This option changes the scale of the histogram so that vertical scaling is not class dependent. The maximum bin count over the entire data set determines the length of the longest line on the display. The lengths of all other lines are determined relative to the maximum. Lines of equal length, therefore, represent identical bin counts.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

32-07-01

DFHIST

09-03-00-00

OPTION

08 - NEXT CLASS

GENERAL DESCRIPTION:

This option displays the histogram of the next available class. It is a scrolling option. The first class on the display is removed, all other classes move down, and the new class appears at the top of the display. The actual class that will appear can be predicted only if the user knows the structure of the data set (classes appear in reverse order to the data tree) and if the user has not previously selected option 00 - SELECT CLASSES.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

DFHIST

09-03-00 -00

OPTION

09 - NEXT PAGE

GENERAL DESCRIPTION:

This option displays the histograms of the next page of classes. The number of pages T in a histogram plot equals the number of classes C divided by the number of classes per page N (plus 1 if there is a remainder). Taking the classes in the reverse order to which they appear in the data tree, this option displays the Pth class, where P is the number of the next page, and every class that follows until there are N displays or no more classes.

N is originally set to 10 or C whichever is smaller. The user can modify N through option 02 - CHNGE PAGE SIZE.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

32-09-01

OPTION

10 - SET THRESHOLDS

GENERAL DESCRIPTION:

This option allows the user to define a maximum of four thresholds for purposes of partitioning the data set. The thresholds are vertical line segments which extend to the upper and lower limits of the display. The user positions them on the display with the control dials. Reselecting this option destroys the thresholds.

DIALOGUE:

System:

(Draws a threshold on the display)

< DIAL 1 ACTIVE. TYPE < CR > TO FIX LINE, < * > < CR > TO ESCAPE. >

User:

(Positions threshold with control dial)

a. CR

b. * and CR

Option (a) fixes the threshold on the screen and if there are not four thresholds on the display repeats 1. If there are four thresholds the overall option is terminated.

Option (b) erases the moving threshold from the screen and terminates the overall option.

ERROR MESSAGES:

None

NEXT FRAME:

DFHIST

32-10-02

DFHIST

09-03-00-00

OPTION

11 - EVALUATE

GENERAL DESCRIPTION:

This option creates one space logic based on the thresholds that are drawn on the histogram plot. The logic is a method of classifying vectors according to the side of a threshold on which they fall. This option evaluates the current data set against the logic and produces a confusion matrix. The user can then determine if the logic is adequate for classifying purposes and save or reject it.

DIALOGUE:

S1 System:

< SELECT REGION 1: L=LEFTMOST, R=RIGHTMOST >

User:

a. L and CR

b. R and CR

S2 System:

Replaces the menu with a list of class symbols. Labels a region.
The display regions are being numbered from left to right or right to left depending on the user response to 1.< USE LIGHT PEN TO
SELECT SYMBOLS (*=REJECT) FOR REGION N, THEN TYPE CR. >(N is the
region number).

User:

User touches a class symbol in the list with the light switch
inactive. Otherwise: carriage return (go to S6)

S2 System:

Points to selected symbol with a display arrow.

User:

User touches a class symbol in the list with the light pen. If the switch is not active, repeat S3. If the switch is active and the symbol has not been previously selected for the region, go to S4. If the switch is active and the class has been previously selected, go to S5. Otherwise: carriage return (go to S6).

S4 System:

Displays N next to the class symbol. This class symbol cannot be selected again unless the user moves the arrow to some other class first. Repeat S3.

S5 System:

Remove N which is displayed next to the symbol. This class symbol cannot be selected again unless the user moves the arrow to some other class first. Repeat S3.

S6 System:

User has typed carriage return. If there are two or more unlabeled regions, begin again at S2. Otherwise: < USE LIGHT PEN TO SELECT SYMBOLS (*=REJECT) FOR REMAINING REGION, THEN TYPE CR. >

User:

Similar to S2 and S3. Otherwise: carriage return.

S7 System:

Restores menu. If every symbol, not including the * has been selected at least once, proceed at S8. Otherwise for unselected symbol x, re-label regions and: < X NOT ASSIGNED. TYPE REGION NUMBER (R=REMAINING REGION). >

User:

N and CR (N is the region number. Repeat S7).

S8 System:

< LOGIC COMPUTATION IN PROGRESS >

User:

No response required.

S9 System:

< CALCULATING CONFUSION MATRIX >

User:

No response required.

S10 System:

(Displaying confusion matrix)

< LINE PRINTER COPY? (Y) >

User:

a. CR

b. Y and CR

(Option b duplicates the confusion matrix on the line printer.)

S11 System:

< DETAILED ERROR LISTING? (Y) >

User:

a. CR

b. Y and CR

(Option b produces a list of misclassified vectors on the line printer).

S12 System:

< TYPE A=ACCEPT OR R=REJECT LOGIC >

User:

- a. A and CR (go to S13)
- b. R and CR (go to S15)

S13 System:

< PARTIAL EVALUATION IN PROGRESS >

User:

No response required.

S14 System:

< EVALUATION COMPLETE (new frame CRELOG) >

S15 System:

< DOT PRODUCT COMPUTATION IN PROGRESS >

User:

No response required.

S16 System:

< HISTOGRAM COMPUTATION IN PROGRESS >

User:

No response required.

S17 System:

(Reproduces histogram)

ERROR MESSAGES:

< NO BOUNDARIES FOR LOGIC COMPUTATION. >

User has failed to draw any thresholds.

< FILE ACCESS ERROR. >

Data set could not be retrieved.

< FAILED TO FIND SYMBOLS AT NODE X >

Could not retrieve the symbols associated with the current logic node.

< LOGIC FILE ACCESS ERROR >

NEXT FRAME:

CRELOG (If logic is accepted)

DFHIST (If logic is rejected)

SECTION 33

SCATTER PLOT FRAME

Frame Name: DFSCAT

Call Sequence: 09-03-00-00

DFSCAT

09-03-00-00

DISTRIBUTION FREE LOGIC DESIGN SCATTER PLOT

GENERAL DESCRIPTION:

This frame accompanies the 2 space scatter plot under logic design. Its options deal primarily with manipulations of the basic plot. Included is an option to create and evaluate 2 space logic.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 NEXT PAGE	33-00-01
01 CHANGE SCALE	33-01-01
02 PRINT IDS	33-02-01
03 BLINK	33-03-01
04 ELIMINATE	33-04-01
05 Blank	
06 ZOOM	33-06-01
07 DRAW BOUNDARY	33-07-01
08 EVALUATE	33-08-01
09 SELECT BASIS	22-13-01
10 Blank	
11 RET CRELOG FRM	31-1
12 RET DF FRM	30-1
13 RET OLPARS FRM	20-1
14 RET INIT FRAME	2-1
15 HARDCOPY	

AD-A032 305

PATTERN ANALYSIS AND RECOGNITION CORP ROME N Y F/G 9/2
THE WAVEFORM PROCESSING SYSTEM. USER'S MANUAL FOR THE WAVEFORM --ETC(U)
SEP 76 P K SANYAL, C BERSTER, T MCGIBBON F30602-72-C-0193
PAR-76-6 RADC-TR-76-224-VOL-2 NL

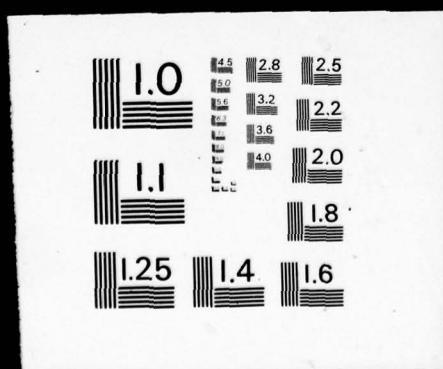
UNCLASSIFIED

6 of 7
ADA032305



6 OF

ADA032305



DFSCAT

09-03-00-00

OPTION

00 - NEXT PAGE

GENERAL DESCRIPTION:

This option plots the next page of vectors in the current data set. They are plotted according to the current scaling parameters as set by default, the CHANGE SCALE option (01), or the ZOOM option (07). Paging and scaling information is displayed along with the plot. Pages are defined after the user selects the scatter plot option (see CRELOG) and before the 2SPACE frame is displayed (at which time, page 1 is plotted). The number of pages in the plot (p) is equal to the total number of vectors (T) in the data set, divided by 500 (plus 1, if there is a remainder). The number of vectors on a page is equal to T divided by P (minus 1 on the pth page if T divided by p leaves a remainder). If x is any page, then a given vector belongs to x if, taken in order of its appearance in the data set, it can be labeled as the (x+Np)th vector, where N=0,1,2...(T/p-1). If the current page is the last page, then the first page will be replotted.

DIALOGUE:

None

ERROR MESSAGES:

<FILE ACCESS ERROR >

Indicates an error occurred in attempting to access a data file.

Although it could be caused by a fault in the structure of the data file, it is most likely a hardware error.

NEXT FRAME:

DFSCAT

OPTION

01 - CHANGE SCALE

GENERAL DESCRIPTION:

This option changes the scaling parameters and replots the current page of vectors. These parameters are used to map the floating point vectors of the data set to the display screen coordinate system. Their default values as set after the user selects the scatter plot option (see CRELOG) and before the 2SPACE frame is displayed are: Global Scale and Square Scale. Scaling and paging information is displayed along with the plot.

The scaling parameters are defined as follows:

- Global Scale: The scale based on the minimum and maximum values of the dot product of all vectors in the data set with the projection vectors selected in STRANL.
- Local Scale: The scale based on the minimum and maximum values of the dot product of all vectors on the current page with the projection vectors selected in STRANL.
- Zoom Scale: The scale based on the minimum and maximum values in the x and y directions as determined by the user in the ZOOM option (07).
- Rectangular Scale: The scaling of the x and y directions independently, allowing for maximum use of the display screen.
- Square Scale: The scaling of the x and y directions identically so that equal changes in the x and y coordinates on the screen represent equal changes in the actual x and y values of the projected vectors. The scaling factor of the direction with the greatest range is used.

A plot is either Global, Local or Zoom and Rectangular or Square. Thus in this option the user selects Global or Local and/or Rectangular or Square. Zoom is selected by the ZOOM option (07) and is altered or abandoned by selections in the CHANGE SCALE option.

DIALOGUE:

System:

< SELECT SCALE: G(GLOBAL), L(LOCAL), R(x≠y), S(x=y), GR, GS, LR or
LS.>

User:

The user can respond with one of the following inputs:

- a. G CR
- b. L CR
- c. R CR
- d. S CR
- e. GR CR
- f. GS CR
- g. LR CR
- h. LS CR

Option (a) selects Global Scale, (b) selects Local, (c) selects Rectangular (d) selects Square, (e) selects Global and Rectangular, (f) selects Global and Square, (g) selects Local and Rectangular and (h) selects Local and Square.

ERROR MESSAGES:

None

NEXT FRAME:

DFSCAT

DFSCAT

09-03-00-00

OPTION

02 - PRINT IDS

GENERAL DESCRIPTION:

This option prints on the line printer the ID number, class symbol, and unscaled x,y projection values of user indicated vectors. The user holds the light pen against any plotted class symbol (representing a vector), waits for the plot to respond to the selection, and then presses the light pen switch. (The plot responds to the selection by increasing the size of the class symbol which the light pen senses). All vectors which are currently plotted and whose display coordinates are equal to the display coordinates of the selected symbol are then output to the line printer in the form:

Vector ID	Class Symbol	Measurement X	Measurement Y
-----------	--------------	---------------	---------------

The user repeats this sequence as often as he likes and terminates the option through a keyboard response.

DIALOGUE:

System:

< LIGHT PEN VECTOR. TYPE < CR> TO ESCAPE.>

User:

CR User terminates the option with a carriage return when he has finished selecting vectors with the light pen.

ERROR MESSAGES:

None

The user should note that the option prints header information on the line printer prior to displaying the system dialogue message. If the message fails to appear, the user should insure that the line printer is on line.

NEXT FRAME:

DFSCAT

33-02-01

OPTION

03 - BLINK

GENERAL DESCRIPTION:

This option controls the display blink function allowing the user to cause all the vectors of any selected class to blink on and off when plotted. Once enabled, a class continues to blink over all other options in this frame, excluding the Select Basis option (10).

The user selects classes for blinking with the light pen. The frame option menu is temporarily destroyed and replaced by a list of class symbols. Each class symbol is preceded by a beta (β), indicating that the class is blinking, an epsilon (ϵ), indicating that the class has been eliminated, or a blank. The user moves the light pen over this list and an arrow keeps track of the last class symbol sensed by the light pen. When the user presses the light pen switch, action is taken on the class to which the arrow is pointing. If the class is not blinking, the blink is enabled and a β is displayed before the class. If the class is blinking, the blink is disabled and the β removed. (If the class is eliminated the attempted action will be ignored.) Once action has been taken on a class, the arrow must be moved to another class before any further action can take place. After moving the arrow, the user can reselect the previous class or any other class in the list.

DIALOGUE:

System:

<LIGHT PEN ACTIVE.TYPE: </ > TO CLEAR ALL, < CR > TO ESCAPE >

User:

The user can respond with one of the following inputs:

- a. / CR
- b. / CR CR
- c. CR

Option (a) disables the blink for all classes. Option (b) disables the blink for all classes, terminates the BLINK option, and

restores the frame option menu. Option (c) terminates the BLINK option and restores the frame option menu.

ERROR MESSAGES:

None

NEXT FRAME:

DFSCAT

OPTION

04 - ELIMINATE

GENERAL DESCRIPTION:

This option allows the user to eliminate all vectors of any selected class from the display. Once a class is eliminated it remains undisplayed over all other options in this frame, excluding the Select Basis option (10). Since the elimination is purely a display function, scaling parameters and the paging scheme are not affected.

The user selects classes for elimination with the light pen. The frame option menu is temporarily destroyed and replaced by a list of class symbols. Each class symbol is preceded by an epsilon (ϵ) indicating that the class has been eliminated, a beta (β), indicating that the class is blinking, or a blank. The user moves the light pen over this list and an arrow keeps track of the last class symbol sensed by the light pen. When the user presses the light pen switch, action is taken on the class to which the arrow is pointing. If the class has not been eliminated, it is eliminated and a ϵ is displayed before the class. If the class has been eliminated, it is restored and the ϵ removed. (If the class is blinking, the attempted action will be ignored.) Once action has been taken on a class, the arrow must be moved to another class before any further action can take place. After moving the arrow, the user can reselect the previous class or any other class in the list.

DIALOGUE:

System:

< LIGHT PEN ACTIVE.TYPE: </> TO CLEAR ALL, <CR> TO ESCAPE >

User:

The user can respond with one of the following inputs:

- a. / CR
- b. / CR CR
- c. CR

Option (a) restores all classes. Option (b) restores all classes, terminates the ELIMINATE option, and restores the frame option menu. Option (c) terminates the ELIMINATE option and restores the frame option menu.

ERROR MESSAGES:

None

NEXT FRAME:

DFSCAT

33-04-02

OPTION

06 - ZOOM

GENERAL DESCRIPTION:

This option allows the user to magnify any area of the displayed plot. When the option is selected a square appears on the display screen. The user manipulates the position and size of the square to define an area for magnification. Potentiometer 1 or Control Dial 1 controls the positioning of the square in the x direction, dial 2 controls the positioning in the y direction, and dial 3 controls the size of the square. The user defined area is then translated and expanded to fill the entire display coordinate space, rescaling all vectors that are within that area and excluding all that are not. The user can restore the original plot through the CHANGE SCALE option (01). Until then, the zoom effect remains active over all other options in this frame, except the Select Basis option (10).

DIALOGUE:

System:

< DIALS 1-3 ACTIVE. TO FREEZE BOX AND PROCEED TYPE < CR> >

User:

CR The user responds when the square defines the desired area of the plot.

ERROR MESSAGES:< ERROR: SELECTED RANGES $\leq \emptyset$ >

Indicates that the selected range is unplottable.

NEXT FRAME:

DFSCAT

OPTION

07 - DRAW BOUNDARY

GENERAL DESCRIPTION:

This option allows the user to draw a maximum of two, six segment boundaries on the displayed plot for the purpose of creating two space logic. The boundaries are drawn with the data tablet and stylus, and are retained over all other options in this frame, except for the SELECT BASIS option (10). Re-selection of the DRAW BOUNDARIES option automatically erases any previously drawn boundaries.

To draw a boundary, the user brings the attached stylus close to, but not touching the surface of the data tablet, activating a display screen cursor (a large plus sign), the position of which is dependent on the position of the stylus relative to the tablet surface. The user then fixes the initial point in the boundary by pressing the tip of the stylus against the tablet. A line segment is immediately drawn between the fixed point and the cursor such that the length and direction of the segment varies with movement of the cursor. The user terminates the segment and fixes its position by pressing the stylus against the tablet again. A new line segment is then drawn between the second fixed point and the cursor. This sequence continues until the user terminates the boundary through a keyboard response, or by completing six line segments.

The cursor disappears from the screen whenever the user takes the stylus out of proximity with the tablet. The adjustable line segment also disappears, but fixed line segments remain on the screen. Bringing the stylus back in proximity will restore the adjustable line, unless the user has terminated the boundary or the boundary has no fixed line segments. (Thus no boundary exists if the user deletes all of its fixed segments or removes the cursor after fixing only the initial point.)

Keyboard responses are ignored as long as the cursor is on the screen. When it is removed the user has four options: (1) Terminate the boundary (if a boundary is not terminated, it is erased from the screen when the Escape option is selected), (2) Close Boundary terminates the boundary by drawing a line segment between the first and last fixed points in the boundary), (3) Delete Line (deletes the last fixed line segment from the screen. If that segment belongs to a terminated boundary, the resulting boundary is not considered terminated), and (4) Escape (erases any unterminated boundary and returns the user to the frame options).

After termination of the first boundary, all subsequent data tablet inputs are interpreted as belonging to a second boundary. After the second boundary is terminated all subsequent data tablet inputs are ignored and the only options open to the user are Delete Line and Escape.

DIALOGUE:

System:

< DATA TABLE ACTIVE. < t > = terminate boundary, < c > = CLOSE BOUNDARY,
< d > = DELETE LINE, < e > = ESCAPE. >

User:

The user can respond with one of the following inputs:

- a. t CR
- b. c CR
- c. d CR
- d. e CR

Option (a) terminates the boundary; that is, classes it to all further data tablet input. (b) draws a line segment between the first and last point of the boundary and terminates it. (c) deletes the last line segment from the screen and if it belongs to a terminated boundary opens the boundary to further data tablet input. (d) erases any unterminated boundary and returns the user to the frame options.

ERROR MESSAGES:

None

NEXT FRAME:

DFSCAT

DFSCAT

09-03-00-00

OPTION

08 - EVALUATE

GENERAL DESCRIPTION:

This option creates two space logic based on the boundaries that are drawn on the scatter plot. The logic is a method of classifying vectors according to the side of a boundary on which they fall. This option evaluates the current data set against the logic and produces a confusion matrix. The user can then determine if the logic is adequate for classifying purposes and save or reject it.

DIALOGUE:

S1 System:

(If there is only one boundary begin with S4)

< SELECT BOUNDARY WITH LIGHT PEN >

User:

(User touches a boundary with the light pen. The light pen switch is not active.)

S2 System:

(Marks the selected boundary with an x)

User:

User touches a boundary with the light pen. If the switch is not active, repeat S2. If active, proceed to S3.

S3 System:

<BOUNDARY SELECTED>

(May disappear too rapidly to be seen)

S4 System:

(Removes the menu and displays a list of classes. Marks a boundary with an x. Displays a plus sign cursor.)

33-08-01

< USE DIALS TO MOVE CURSOR TO CONVEX SIDE OF MARKED BOUNDARY, THEN
TYPE CR. >

User:

(After moving cursor)

Carriage Return.

S5 System:

(Labels the region that contained the cursor as N, where N=1 or 2).

< USE LIGHT PEN TO SELECT SYMBOLS (*=REJECT) FOR REGION N, THEN TYPE CR. >

(N is the region number)

User:

(User touches a class symbol in the list with the light switch
inactive. Otherwise: carriage return (go to S7)).

S6 System:

(Points to selected symbol with a display arrow)

User:

User touches a class symbol in the list with the light pen. If
the switch is not active, repeat S6. If the switch is active and
the symbol has not been previously selected for the region, go to
S7. If the switch is active and the class has been previously
selected, go to S8. Otherwise: Carriage return (go to S9).

S7 System:

Displays N next to the class symbol. This class symbol cannot be
selected again unless the user moves the arrow to some other class
first. Repeat S6).

S8 System:

Removes N which is displayed next to the symbol. This class symbol cannot be selected again unless the user moves the arrow to some other class first. Repeat S6).

S9 System:

(User has typed carriage return. If there are two or more unlabeled regions, begin again at S4. Otherwise:)

<USE LIGHT PEN TO SELECT SYMBOLS (*=REJECT) FOR REMAINING REGION,
THEN TYPE CR. >

User:

(Similar to S5 and S6. Otherwise: carriage return).

S10 System:

(Restores menu. If every symbol, not including the * has been selected at least once, proceed at S8. Otherwise for unselected symbol x, relabel regions and:)

<X NOT ASSIGNED. TYPE REGION NUMBER (R=REMAINING REGION). >

User:

N and CR (N is the region number. Repeat S10).

S11 System:

< LOGIC COMPUTATION IN PROGRESS >

User:

No response required.

S12 System:

< CALCULATING CONFUSION MATRIX >

User:

No response required.

S13 System:

(Displaying confusion matrix)

< LINE PRINTER COPY? (Y)>

User:

a. CR

b. Y and CR

(Option G duplicates the confusion matrix on the line printer).

S14 System:

< DETAILED ERROR LISTING? (Y) >

User:

a. CR

b. Y and CR

(Option b produces a list of misclassified vectors on the line printer).

S15 System:

< TYPE A=ACCEPT OR R=REJECT LOGIC >

User:

a. A and CR (go to S16)

b. R and CR (go to S18)

S16 System:

< PARTIAL EVALUATION IN PROGRESS >

User:

(No response required).

S17 System:

< EVALUATION COMPLETE >

(New frame CRELOG)

S18 System:

< DOT PRODUCT CALCULATION IN PROGRESS >

User:

(No response required)

S19 System:

< PAGING >

(Reproduces Scatter plot)

ERROR MESSAGES:

< NO BOUNDARIES FOR LOGIC COMPUTATION >

User has failed to draw any boundaries on the screen.

< FILE ACCESS ERROR >

Data set could not be retrieved.

< FAILED TO FIND SYMBOLS AT NODE X. >

Could not retrieve the symbols associated with the current logic node.

< LOGIC FILE ACCESS ERROR >

NEXT FRAME:

CRELOG (If logic is accepted)

DFSCAT (If logic is rejected)

SECTION 34

LOGIC EVALUATION FRAME

Frame Name: LOGEVL

Call Sequence: 09-03-01

LOGEVL

09-03-01

OVERALL LOGIC EVALUATION

GENERAL DESCRIPTION:

This is the frame for overall logic evaluation.

<u>OPTION</u>	<u>DESCRIPTION ON PAGE</u>
00 - OVERALL EVAL	34-00-01
01 - CHANGE SYMBOLS	34-01-01
02 - Blank	
03 - "	
04 - "	
05 - "	
06 - "	
07 - "	
08 - "	
09 - "	
10 - "	
11 - "	
12 - RET DF FRM	30-1
13 - RET OLPARS FRM	20-1
14 - RET INIT FRAME	2-1
15 - HARDCOPY	

00 - OVERALL EVAL

GENERAL DESCRIPTION:

This option evaluates the vectors of a "test" data set against the logic in a logic tree. The user must select both the data set and the logic tree. A confusion matrix is the result of the evaluation and will be displayed on either the Vector General or line printer. The reassociated symbols located in the logic file are used to determine whether or not each vector is classified correctly. There is a reassociated symbol for each symbol in the logic file. Initially, they are set to the same symbol. When a vector is classified as belonging to a class in the logic tree, the re-associated symbol for that class is compared to the symbol of the vector. If they match, the vector is assumed to be classified correctly. The confusion matrix consists of a plot of the true data class symbols (vertically on left of page) versus the assigned class symbols.

The user may also have the confusion matrix listed having the reassociated symbols as the assigned class symbols. A detailed listing of all misclassified vectors may be requested.

DIALOGUE:

System:

< ENTER LOGIC FILE NAME (CR) FOR CURRENT LOGIC FILE >

User:

The user enters the name of a logic file. He may select the current logic file by entering only a carriage return.

System:

< ENTER VECTOR FILE NAME (CR) FOR CURRENT VECTOR FILE >

User:

The user enters the name of a vector file. He may select the current data set by entering only a carriage return.

System:

< OVERALL EVALUATION IN PROGRESS >

Followed by:

< ENTER V-VG L-LINE PRINTER B-BOTH >

User:

User selects the device for the confusion matrix output.

Legal responses are:

V - Vector General output

L - Line Printer output

B - Output on both the Vector General and Line Printer

If the Vector General has been selected for confusion matrix output and the matrix is too large to be displayed on the VG, the matrix will automatically be broken into several pages and each page will be displayed separately. Then the following system dialogue and user response will occur for each additional page.

System:

< (CR) FOR NEXT PAGE >

User:

User types a carriage return to view the next page of the confusion matrix.

After the entire confusion matrix is printed the following dialogue occurs.

System:

< CONFUSION MATRIX WITH REASSOCIATED SYMBOLS? (Y) >

User:

The user enters a Y to request the confusion matrix.

System:

< DETAILED ERROR LISTING? (Y) >

User:

The user enters a Y for a detailed error listing.

NEXT FRAME:

N/A

01 - CHANGE SYMBOLS

GENERAL DESCRIPTION:

This option allows the user to change the reassociated symbols of a logic tree. This is necessary when the user must perform an overall evaluation and the class symbols of the data set do not match the class symbols of the selected logic tree. The temporary symbols and reassociated symbols of the selected logic tree are displayed on the Vector General. The user must enter the temporary symbol to change followed by the new reassociated symbol.

DIALOGUE:

System:

< ENTER LOGIC FILE NAME (CR) FOR CURRENT LOGIC FILE >

User:

The user enters a logic file name. He may type only a carriage return to designate the current logic file.

System:

< ENTER TEMPORARY SYMBOL, REASSOCIATED SYMBOL (CR) TO EXIT. EXAMPLE:
A, B >

User:

The user enters the temporary symbol and reassociated symbol separated by a comma. If the user enters a carriage return as the first character, the program will exit; otherwise, the user is asked to change another symbol.

ERROR MESSAGES:

< LOGIC FILE ERROR >

Indicates an error occurred attempting to access the file.

<ILLEGAL ENTRY - TRY AGAIN >

Indicates the temporary symbol did not exist in the logic file.

NEXT FRAME:

N/A

SECTION 35

PAIRWISE MODIFICATION FRAME

Frame Name: PWMOD

Call Sequence: 09-03-02

PAIRWISE MODIFICATION

GENERAL DESCRIPTION:

This is the initial frame for pairwise modification functions under OLPARS. Prior to selecting any options in this frame, the user must have selected a current data set and a current logic tree.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 - ARBITRARY VECS	35-00-01
01 - HISTOGRAM	35-01-01
02 - DISCRIM PLANE	35-02-01
03 - BOOLEAN	35-03-01
04 - CHANGE # THRESH	35-04-01
05 - EVALUATE	35-05-01
06 - Blank	
07 - "	
08 - "	
09 - "	
10 - "	
11 - "	
12 - "	
13 - "	
14 - "	
15 - HARDCOPY	

OPTION

00 - ARBITRARY VECs

GENERAL DESCRIPTION:

This option modifies the logic vectors for a class pair in the current pairwise logic node by substituting arbitrary vectors for the two logic vectors. Initially, the two logic vectors are the Fisher direction and the vector orthogonal to it which maximizes the same criterion as the Fisher discriminant. The user selects the class pair involving the modification from a list of symbols displayed on the VG. The user selects one or two arbitrary vectors from the NAME AND SAVE file that will replace the vector(s) associated with the class pair. The NAME AND SAVE file is also displayed on the VG. New threshold values are computed based on the first arbitrary vector and the mean vectors of each class. The user has the option of using all the class data to compute the mean vectors or just the class data residing at the current pairwise mode via logic evaluation. The user selects the threshold number to be used in the "mini" evaluation. The "mini" evaluation is an evaluation involving only the class pair that was modified. The user must accept or reject the new logic for the class pair based on the results of the "mini" evaluation. If accepted, the vectors, thresholds, and threshold number are permanently saved in the logic file, and the logic type for the pair is changed to one space logic.

DIALOGUE:

System:

< ENTER CLASS PAIR >

User:

The user enters two symbols (no blanks or commas) from a list displayed on the VG.

System:

< SELECT VECTOR NUMBER >

User:

The user enters the vector number of a vector in the name and save file. This vector will replace the first logic vector. The name and save file is displayed on the VG.

System:

SELECT VECTOR NUMBER

User:

The user enters a vector number or a carriage return. The vector will replace the second logic vector. If the user enters a carriage return, the vector will not be modified.

System:

ENTER 0 - ALL CLASS DATA 1 - CLASS DATA AT NODE

User:

The user enters a 0 or 1.

System:

SELECT THRESHOLD NUMBER 1-4

User:

The user enters the number of thresholds to use in the evaluation.
Valid responses are one through four.

System:

WAIT - EVALUATION IN PROGRESS

Followed by

ENTER V-VG L-LINEPRINTER B-BOTH

User:

The user selects the output device for printing the confusion matrix.

System:

ENTER A-ACCEPT R-REJECT T-TRY DIFFERENT VEC

User:

The user enters either an A, R, or T.

System:

CHANGE ANOTHER PAIR (Y)

User:

The user enters "Y" to change the vectors of another class pair.

ERROR MESSAGES:

ILLEGAL SYMBOLS - TRY AGAIN

Indicates the user made an error entering the symbols for a class pair. He must reenter the symbols.

OPEN NAMSAV FILE ERR

Indicates the name and save file does not exist or a hardware error occurred accessing the file.

NO ENTRIES IN NAMSAV FILE

Indicates there are not any vectors saved in the name and save file.

NO VECTOR SELECTED

Indicates the user failed to select a vector.

DIMENSION ERROR

Indicates the vectors selected have a different dimensionality than that of the current logic tree. All other errors indicate a hardware error occurred attempting to access a file.

NEXT FRAME:

N/A

PWMOD

09-03-02

OPTION

01 - HISTOGRAM

GENERAL DESCRIPTION:

This option displays a histogram consisting of the projection of the data from two classes in the pairwise logic node onto the first logic vector associated with the pair. Initially, the logic vector is the Fisher direction, but could have been modified by choosing the ARBITRARY VECS option. Five thresholds associated with the logic are also displayed and the user will have the capability of moving the thresholds. Only the class data at the current pairwise logic node will be displayed.

DIALOGUE:

System:

< ENTER CLASS PAIR >

User:

The user enters two symbols (no blanks or commas) from a list displayed on the VG.

System:

< DOT PRODUCT COMPUTATION IN PROGRESS >

Followed by

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< RANGE OF DATA EQUALS ZERO >

Indicates the minimum and maximum were equal and a display cannot be produced.

< NO VECTORS AVAILABLE >

Indicates there were no vectors in the data set residing at the current pairwise node.

< PAIR CONTAINS 2-SPACE LOGIC >

Indicates the logic for the pair is 2-space logic and a histogram cannot be performed.

< PAIR CONTAINS BOOLEAN LOGIC >

Indicates the logic for the pair is Boolean logic. A histogram cannot be performed.

All other errors indicate an error occurred attempting to access a file.

NEXT FRAME:

N/A

OPTION

02 - DISCRIM PLANE

GENERAL DESCRIPTION:

This option displays a scatter plot consisting of the projection of the data from two classes in the pairwise logic node onto the two logic vectors associated with the pair. Initially, the logic vectors are the Fisher direction and the vector orthogonal to it producing the optimal discriminant planes; however, the vectors could have been modified by choosing the ARBITRARY VECS option. If the logic type for the pair is two space logic (accomplished by previously selecting this option, drawing boundaries, and accepting the results), the boundaries associated with the logic are also drawn. This option gives the user the capability of changing the logic type for the selected pair to two space logic. Only the class data at the current pairwise logic node will be displayed.

DIALOGUE:

System:

< ENTER CLASS PAIR >

User:

The user enters two symbols (no blanks or commas) from a list displayed on the VG.

System:

< DOT PRODUCT COMPUTATION IN PROGRESS >

Followed by

< PAGING >

ERROR MESSAGES:

< NO VECTORS AVAILABLE >

Indicates there were no vectors in the data set residing at the current pairwise node.

< FILE ACCESS ERROR >

Indicates an error occurred attempting to access a file.

< PAIR CONTAINS BOOLEAN LOGIC >

Indicates the logic for the pair is Boolean logic. A scatter plot cannot be performed.

NEXT FRAME:

DFSDSP

OPTION

03 - BOOLEAN

GENERAL DESCRIPTION:

This option allows the user to change the logic for a class pair in the current pairwise logic node to Boolean logic. After the user enters the Boolean statement (detailed below), he must enter the class symbol associated with a true response from the logic, and the class symbol associated with a false response. A "mini" evaluation is performed on the data in the two classes located at the current pairwise node. If the logic is accepted, the logic type for the pair is changed to Boolean logic and the logic is permanently saved.

The Boolean statement consists of the combinations of measurement variables, constants, arithmetic operators, relational operators, and logical operations. Following is a discussion of each:

Measurement Variables:

A measurement variable is denoted by the letter "M" (upper or lower case) followed immediately by an integer number. The integer specifies which measurement in the vector is to apply. For example:

M2 denotes the second measurement
m10 denotes the tenth measurement

The integer value must appear immediately after the "M" without embedded blanks; otherwise an illegal measurement or constant error will occur. The measurement number specified must be less than or equal to the dimension of the vector and greater than or equal to one, otherwise an error occurs.

Constants:

All constants are floating point positive values. They are denoted by a sequence of numerals and optionally, a decimal point. Embedded blanks are illegal. For example:

10 ten
100. one hundred
.1 one tenth

Arithmetic Operators:

Arithmetic operators are used to combine measurement variables and constants to form arithmetic expressions. Following is a list of arithmetic operators and their definition:

* multiplication
 / division
 + addition
 - subtraction or negation

An arithmetic expression is formed by alternately combining measurement variables or constants and arithmetic operators. There must be one more measurement variable or constant than the number of arithmetic operators. For example:

- | | |
|-----------------|---|
| (1) $M1-3.0$ | 3 will be subtracted from m1 |
| (2) $m2*2.0-m3$ | m2 will be multiplied by 2 and m3 subtracted |
| (3) $M1-m2/2$ | m2 will be divided by 2 and the quantity subtracted from m1 |

Multiplication and division have a higher hierarchy than addition and subtraction and are performed first. Operators of the same hierarchy are performed from left to right as they appear in the expression. Parentheses may be used to alter the order of operation. Operations in the innermost set of parentheses will be performed first, the second innermost performed second, etc. The interpretation of the third example above could be changed by placing parentheses around the two measurement variables as follows:

$(M1-m2)/2$	m2 will be subtracted from m1 and the quantity divided by 2
-------------	---

An arithmetic expression does not necessarily have to contain an arithmetic operator. A measurement variable or constant alone is a valid arithmetic expression. For example:

M1
 9.4

However, if it is necessary to use the negative value of a variable or constant, the negation operator may be used. The negation operator must be preceded by a left parenthesis unless it is the first character in the statement. Since all parentheses must balance, the right parenthesis must also appear somewhere in the expression. For example:

- | | |
|----------------|---|
| (1) $-M1$ | |
| (2) -9.4 | |
| (3) $m1*(-m2)$ | m2 is negated before multiplying m1 |
| (4) $-m1*m2$ | m1 is multiplied by m2 and the quantity negated |

Note that in the examples above, the number of operators and variables are equal. Negation is the only case where this holds true. Actually, when the statement is interpreted, a zero constant is assumed on the left side of the negation operator.

Relational Operators:

Relational operators are used to form a logical expression from two arithmetic expressions. Since the result of Boolean logic is a logical expression, the statement must contain at least one relational operation. Following is a list of relational operators and their definition:

<		less than	
>		greater than	
=		equal to	
<=	or	=<	less than or equal to
>=	or	=>	greater than or equal to
<>	or	><	not equal to

In forming the last three relational operators, embedded blanks between the two symbols are illegal. Following are some examples of logical expressions:

```
m1 < m2
m1+5.0 <> m2
((m1+1.0)*m2 < m3)
```

Logical Operators:

Logical operators are used to combine logical expressions to produce the logical result of the Boolean statement. Following is a list of logical operators and their definitions:

V	logical or (capital letter v)
^	logical and

The order in which logical operators are performed is from left to right unless logical expressions are enclosed by parentheses. Following are examples of complete Boolean statements.

```
(m1+m2 < m3 V m1 < m4) ^ (m2 3.0V25. < (m1+m2)*(-M1))
m1 < 25 ^ (-m1*m2) < 100
m1 < m2
```

Parentheses are used to change the order in which arithmetic and logical operations are performed. All parentheses must balance, and parentheses within arithmetic and logical expressions must balance as well. For example:

```
m1 + (m2 < m3)
```

is an illegal statement because the parentheses form a logical expression and an arithmetic operator cannot combine an arithmetic and logical expression. Another example of misuse of parentheses is:

```
m2(m3Vm3 > 2.0)
```

Here, the logical OR operator is attempting to combine an arithmetic expression with a logical expression. In the above two illegal examples, if the parentheses were omitted, the statements would be perfectly legal.

The hierarchy of operation is as follows:

LEVEL	OPERATOR	TYPE
5	()	Parentheses
4	*/	Arithmetic
3	+ -	Arithmetic
2	>, <, =	Relational
	> =, = >	
	< =, = <	
	> <, < >	
1	V A	Logical

Operations at a higher level will be performed before operations at a lower level. If two operations are at the same level, they will be performed as they appear in the statement, from left to right. Operations in parentheses will be performed first, starting with the innermost set of parentheses.

DIALOGUE:

System:

< ENTER CLASS PAIR >

User:

The user enters two symbols (no embedded blanks or commas) from a list displayed on the VG.

System:

< ENTER BOOLEAN STATEMENT CR TO TERMINATE CHARACTER SET *1+-<> =

^V () Mm 123456789. >

User:

The user enters the Boolean statement. The user may enter the statement on successive lines, and each line is displayed on the VG. Blanks between operators and variables are ignored, and a carriage return as the first character of the line terminates the Boolean statement.

System:

< ENTER SYMBOL FOR TRUE RESPONSE >

User:

The user enters the symbol associated with a true response from the logic.

System:

< ENTER SYMBOL FOR FALSE RESPONSE >

User:

The user enters the symbol associated with a false response from the logic.

System:

< WAIT - EVALUATION IN PROGRESS >

Followed by:

< ENTER V-VG L-LINE PRINTER B-BOTH >

User:

The user enters V L or B designating the output device for the confusion matrix.

System:

< ENTER A-ACCEPT R-REJECT T-TRY ANOTHER STATEMENT >

User:

The user enters A R or T.

ERROR MESSAGES:

< BOOLEAN STATEMENT ERROR >

Indicates an error in the Boolean statement.

< ERROR IN ENTRY - TRY AGAIN >

Indicates the user made an error entering the symbols for a true and false response.

All other errors indicate a hardware error occurred accessing a file.

< TOO MANY PARENTHESES >

Indicates the user entered more than 64 levels of parentheses.

< PARENTHESES DO NOT BALANCE >

Indicates a left or right parenthesis is missing.

< SYNTAX ERROR - ILLEGAL CHARACTER >

Indicates an unrecognizable character appears in the statement.

< ILLEGAL OPERATORS >

Indicates an illegal combination of relational operators appears in the statement.

< MEAS # EXCEEDS DIMENSION >

Indicates a measurement number has been entered that exceeds the dimension of the vector file.

< INCOMPLETE STATEMENT >

Indicates that another arithmetic or logical expression is necessary to complete the statement.

< SYNTAX ERROR - ILLEGAL MEASUREMENT >

Indicates a measurement number was less than one or greater than 255.

< ILLEGAL STATEMENT >

Indicates the user entered a generally unacceptable statement.

All other error messages indicate a hardware error occurred when attempting to perform the reported operation.

NEXT FRAME:

N/A

PWMOD

09-03-02

04 - CHANGE # THRESH

GENERAL DESCRIPTION:

This option allows the user to change the threshold number in the logic for a class pair in the current pairwise logic node if the logic type for the pair is either Fisher vectors or histogram. A "mini" evaluation is performed on the data in the two classes located at the current pairwise node using the new threshold number. If the logic is accepted, the new threshold number is permanently saved with the logic for the pair. The threshold number reflects the number of thresholds used to classify the vector. One to four thresholds may be used.

DIALOGUE:

System:

< REPLACE ALL THRESHOLDS? (Y) >

User:

The user types a Y if the threshold for each pair is to be replaced by the same threshold number.

System:

< ENTER CLASS PAIR > (if the response to the previous question was no)

User:

The user enters two symbols from a list displayed on the VG.

System:

< ENTER THRESHOLD NUMBER 1-4 >

User:

The user enters a threshold number between 1 and 4 inclusive.

System:

< CHANGE ANOTHER PAIR? (Y) >

(if the user is changing thresholds one at a time)

User:

The user enters a Y if another threshold is to be changed.

ERROR MESSAGES:

< ILLEGAL THRESHOLD - TRY AGAIN >

Indicates the user did not enter a threshold number between
1 and 4 inclusive.

All other errors indicate an error occurred attempting to access
a file.

NEXT FRAME:

N/A

05 - EVALUATE

GENERAL DESCRIPTION:

This option evaluates the logic at the current pairwise logic node and prints a confusion matrix of the results. Control is returned to the logic design frame (LOGDES). This option should be selected after the user has completed all pairwise modification operations. The resulting confusion matrix reflects the modifications made to the pairwise logic.

The user is required to specify a minimum vote count that is saved with the logic and used in the evaluation. For each vector passed through the logic, a tally of votes is accumulated for each class and the vector is assigned to the class receiving the most votes if greater than or equal to the minimum vote count. Otherwise the vector is rejected and assigned to the reject node.

The user has the option of requesting the output of the confusion matrix on either the line printer, Vector General, or both. He may also request a detailed listing of all misclassified vectors.

DIALOGUE

System:

< ENTER MINIMUM VOTE COUNT RANGE 0-n >

where n is the number of classes at the node minus one.

User:

The user enters the minimum vote count.

System:

< PAIRWISE EVALUATION IN PROGRESS >

Followed by:

< ENTER V-VG L-LINE PRINTER B-BOTH >

User:

User selects the device for the confusion matrix output.

Legal responses are:

V - Vector General output

L - Line Printer output

B - Output on both the Vector General and Line Printer.

If the Vector General has been selected for confusion matrix output and the matrix is too large to be displayed on the VG, the matrix will automatically be broken into several pages and each page will be displayed separately. Then the following system dialogue and user response will occur for each additional page.

System:

< (CR) FOR NEXT PAGE >

User:

User types a carriage return to view the next page of the confusion matrix. After the entire confusion matrix is printed the following dialogue occurs.

System:

< DETAILED ERROR LISTING? (Y) >

User:

The user types a Y to request a detailed listing of misclassified vectors.

ERROR MESSAGES:

All errors indicate an error occurred attempting to access a file.

SECTION 36

HISTOGRAM FOR FISHER PAIRWISE MODIFICATION FRAME

Frame Name: DFHFSH

Call Sequence: 09-03-02-01

FISHER PAIRWISE MODIFICATION HISTOGRAM

GENERAL DESCRIPTION:

This frame accompanies the 1 space Fisher pairwise modification histogram plot under logic design. Its options deal primarily with manipulations of the basic plot. It includes an option to create and evaluate new logic based on the movement of the Fisher thresholds.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 CHNGE BIN PARAMS	36-00-01
01 ZOOM OPTIONS	24-1
02 COMPARE CLASSES	36-02-01
03 LOCAL VERT SCL	36-03-01
04 GLOBAL VERT SCL	36-04-01
05 DISP BIN COUNT	36-05-01
06 MOVE THRESHOLDS	36-06-01
07 RE-SELECT PAIR	36-07-01
08 EVALUATE	36-08-01
09 Blank	
10 "	
11 "	
12 "	
13 "	
14 RET PWISE FRM	35-1
15 HARDCOPY	

DFHFSH

09-03-02-01

OPTION

00 - CHANGE BIN PARAMETERS

GENERAL DESCRIPTION:

This option allows the user to **change** one of two scaling factors of the histogram plot: (1) the number of bins or (2) the size of a bin. The histogram will be completely recalculated on the basis of the user's input.

DIALOGUE:

System:

< SELECT OPTION: A=CHANGE # OF BINS, B=CHANGE BIN SIZE. >

User:

a. A and CR

b. B and CR

Option a)

System:

< ENTER # OF BINS. MAXIMUM=100. >

User:

N and CR (where N equals the new number of bins).

Option b)

System:

< ENTER NEW BIN SIZE. >

User:

E and CR (E is a number not to exceed 20 characters. E can be in exponential format).

System:

< DO YOU WANT TO KEEP THE SAME # OF BINS? (Y=YES) >

User:

- a. Y and CR
- b. CR

System:

< NEW RANGE MUST BE COMPUTED. TYPE: A=KEEP SAME MINIMUM,
B=KEEP SAME MAXIMUM, C=KEEP SAME MIDPOINT.>

User:

- a. A and CR
- b. B and CR
- c. C and CR

The range of the data is the product of the bin size and the number of bins. The range is expanded or decreased by (a) increasing or decreasing the maximum (b) decreasing or increasing the minimum or (c) decreasing the minimum and increasing the maximum or increasing the minimum and decreasing the maximum.

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< MAXIMUM=100, TRY AGAIN >

The user has selected too many bins.

< FORMAT ERROR. NEW BIN SIZE=?>

The string of characters that the user typed could not be interpreted as a number.

<ERROR: RANGE OF DATA = Ø >

< FILE ACCESS ERROR >

The data set could not be retrieved.

NEXT FRAME:

DFHFSH

DFHFSH

09-03-02-01

OPTION

02 - COMPARE CLASSES

GENERAL DESCRIPTION:

This option allows the user to compare displayed classes by vertically moving the image of any selected histogram over the display space.

The user activates a class by passing the light pen with the switch pressed over the histogram on the display. Once a class is activated a second image of the histogram appears on the screen and is moved vertically by use of potentiometer or control dial 1. The user deactivates a class by activating another or by terminating the option. The option is terminated with a keyboard response.

DIALOGUE:

System:

< ACTIVATE CLASS WITH LIGHT PEN. MOVE CLASS WITH CONTROL DIAL 1.

TYPE < CR > TO ESCAPE. >

User:

CR The user types CR to terminate the option.

ERROR MESSAGES:

None

NEXT FRAME:

DFHFSH

DFHFSH

09-03-02-01

OPTION

03 - LOCAL VERT SCL

GENERAL DESCRIPTION:

This option changes the scale of the histogram so that vertical scaling is class dependent. The maximum bin count in each class will be represented by a line that is the same length in every class, but which does not necessarily indicate that the bin counts are identical. All other bin counts will be plotted relative to the maximum bin count of the same class.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME.

DFHFSH

36-03-01

DFHFSH

09-03-02-01

OPTION

04 - GLOBAL VERT SCL

GENERAL DESCRIPTION:

This option changes the scale of the histogram so that vertical scaling is not class dependent. The maximum bin count over the entire data set determines the length of the longest line on the display. The lengths of all other lines are determined relative to the maximum. Lines of equal length, therefore, represent identical bin counts.

DIALOGUE:

None

ERROR MESSAGES:

None

NEXT FRAME:

DFHFSH

36-04-01

DFHFSH

09-03-02-01

OPTION

05 - DISP BIN COUNT

GENERAL DESCRIPTION:

This option displays the number of vectors of each class on the current page contained in any user selected bin. The user moves a small arrow across the top of the display by means of potentiometer or control dial 1. As the arrow moves from one bin to another a message of the form BIN N, COUNT=C is displayed in the lower left hand corner of each histogram. N is the number of the bin to which the arrow is pointing and C is the number of vectors of the given class which are in that bin.

DIALOGUE:

System:

< DIAL 1 ACTIVE. TYPE CR TO ESCAPE. >

User:

CR The user responds with a carriage return to terminate the option. The bin count messages disappear.

ERROR MESSAGES:

None

NEXT Frame;

DFHFSH

36-05-01

DFHFSH

09-03-02-01

OPTION

06 - MOVE THRESHOLDS

GENERAL DESCRIPTION:

This option allows the user to move the Fisher thresholds using the control dials. It will also replot the histogram if any of the thresholds the user wants to move are not plotted.

Note that the five thresholds are distinguished from each other as follows: 1 and 5 are dotted lines, 2 and 4 are dashed lines, and 3 is a solid line.

DIALOGUE:

System:

< TYPE THRESHOLD # (1-5), THEN USE DIAL 1 TO MOVE IT. TYPE < CR >
TO EXIT. >

User:

- a. N and CR (where N is the threshold number)
- b. CR

Option (b) terminates the overall option.

System:

(If the selected threshold is plotted, proceed with 5; otherwise:)
< THRESHOLD OUTSIDE OF RANGE. REPLOT? (Y) >

User:

- a. Y and CR
- b. CR

Option (b) restarts at 1. For option a:)

System:

< HISTOGRAM COMPUTATION IN PROGRESS >

36-06-01

User:

No response required.

System;

Begin again at 1.

System:

The selected threshold can now be moved with control dial 1.

Begin again at 1.

ERROR MESSAGES:

< FILE ACCESS ERROR >

Data set could not be retrieved.

NEXT FRAME:

DFHFSH

07 - RESELECT PAIR

GENERAL DESCRIPTION:

This option allows the user to reselect a class pair at the current pairwise logic node and display a new histogram consisting of the projection of the data from the two classes onto the first logic vector associated with the pair. Five thresholds associated with the logic are also displayed and the user will have the capability of moving the thresholds. Only the class data at the current pairwise logic node will be displayed.

DIALOGUE:

System:

< ENTER CLASS PAIR >

User:

The user enters two symbols from a list displayed on the VG.

System:

< DOT PRODUCT COMPUTATION IN PROGRESS >

Followed by:

< HISTOGRAM COMPUTATION IN PROGRESS >

ERROR MESSAGES:

< RANGE OF DATA EQUALS ZERO >

Indicates the minimum and maximum were equal and a display cannot be produced.

< NO VECTORS AVAILABLE >

Indicates there were no vectors in the data set residing at the current pairwise node.

All other errors indicate an error occurred attempting to access a file.

NEXT FRAME:

N/A

36-07-02

DFHFSH

09-03-02-01

08 - EVALUATE

GENERAL DESCRIPTION:

This option performs a "mini" evaluation involving the class pair that were selected previously (option 01, frame PWMOD or option 07, frame DFHFSH).

Each vector in both classes is projected on the first logic vector and compared to the threshold values currently displayed on the Vector General. The user must select the threshold number to use.

The vector is classified depending on the region in which the vector falls. A confusion matrix of the results is printed and a detailed listing of all misclassified vectors may be requested. If the user accepts the logic for the class pair, the threshold values currently being displayed and the threshold number are saved in the logic for the class pair.

DIALOGUE:

System:

< ENTER NUMBER OF THRESHOLDS TO USE (1-4) >

User:

The user selects the number of thresholds to use.

System:

< WAIT - EVALUATION IN PROGRESS >

Followed by:

< ENTER V-VG L-LINE PRINTER B-BOTH >

User:

User selects device for output of the confusion matrix.

System:

< ENTER A-ACCEPT R-REJECT T-TRY A DIFFERENT THRESHOLD >

User:

The user types an A, R, or T. If the user elects to try a different

threshold, the system asks for the threshold number and the evaluation is performed again.

System:

< ANOTHER HISTOGRAM? (Y) >

User:

The user types a Y to request the histogram of another class pair in the pairwise logic node.

ERROR MESSAGES:

< PAIR CONTAINS 2-SPACE LOGIC >

Indicates the logic for the selected pair is 2-space logic. A histogram cannot be displayed.

< PAIR CONTAINS BOOLEAN LOGIC >

Indicates the logic for the selected pair is Boolean logic. A histogram cannot be displayed.

All other errors indicate an error occurred attempting to access a file.

NEXT FRAME:

PWMOD

SECTION 37

SCATTER PLOT FOR DISCRIM PLANE FOR PAIRWISE MODIFICATION

Frame Name: DFSDSP

Call Sequence: 09-03-02-02

LOGIC DESIGN DISCRIMINANT PLANE SCATTER PLOT

GENERAL DESCRIPTION:

This frame accompanies the 2 space Fisher discriminant plane plot under logic design. Its options deal primarily with manipulations of the basic plot. It includes an option to create and evaluate 2 space logic.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 NEXT PAGE	37-00-01
01 CHANGE SCALE	37-01-01
02 PRINT IDS	37-02-01
03 BLINK	37-03-01
04 ELIMINATE	37-04-01
05 Blank	
06 ZOOM	24-1
07 DRAW BOUNDARY	37-07-01
08 RE-SELECT PAIR	37-08-01
09 EVALUATE	37-09-01
10 Blank	
11 "	
12 "	
13 "	
14 RET PWISE FRM	35-1
15 HARDCOPY	

OPTION

00 - NEXT PAGE

GENERAL DESCRIPTION:

This option plots the next page of vectors in the current data set. They are plotted according to the current scaling parameters as set by default, the CHANGE SCALE option (01), or the ZOOM option (07). Paging and scaling information is displayed along with the plot.

Pages are defined after the user selects the scatter plot option (see STRANL) and before the 2SPACE frame is displayed (at which time page 1 is plotted). The number of pages in the plot (p) is equal to the total number of vectors (T) in the data set divided by 500 (plus 1, if there is a remainder). The number of vectors on a page is equal to T divided by p (minus 1 on the pth page if T divided by p leaves a remainder). If x is any page, then a given vector belongs to x if, taken in order of its appearance in the data set, it can be labeled as the $(x+Np)^{\text{th}}$ vector, where $N=0,1,2,\dots,(T/p-1)$. If the current page is the last page, then the first page will be replotted.

DIALOGUE:

None

ERROR MESSAGES:

< FILE ACCESS ERROR >

Indicates an error occurred in attempting to access a data file.

Although it could be caused by a fault in the structure of the data file, it is most likely a hardware error.

NEXT FRAME:

DFSDSP

OPTION

01 - CHANGE SCALE

GENERAL DESCRIPTION:

This option changes the scaling parameters and replots the current page of vectors. These parameters are used to map the floating point vectors of the data set to the display screen coordinate system. Their default values, as set after the user selects the scatter plot option (see PWMOD) and before the 2SPACE frame is displayed, are: Global Scale and Square Scale. Scaling and paging information is displayed along with the plot.

The scaling parameters are defined as follows:

- Global Scale: The scale based on the minimum and maximum values of the dot product of all vectors in the data set with the projection vectors selected in STRANL.
- Local Scale: The scale based on the minimum and maximum values of the dot product of all vectors on the current page with the projection vectors selected in STRANL.
- Zoom Scale: The scale based on the minimum and maximum values in the x and y directions as determined by the user in the ZOOM option (07).
- Rectangular Scale: The scaling of the x and y directions independently, allowing for maximum use of the display screen.
- Square Scale: The scaling of the x and y directions identically so that equal changes in the x and y coordinates on the screen represent equal changes in the actual x and y values of the projected vectors. The scaling factor of the direction with the greatest range is used.

A plot is either Global, Local or Zoom and Rectangular or Square. Thus in this option the user selects Global or Local and/or Rectangular or Square. Zoom is selected by the ZOOM option (07) and is altered or abandoned by selections in the CHANGE SCALE option.

DIALOGUE:

System:

< SELECT SCALE: G(GLOBAL), L(LOCAL), R(x≠y), S(x=y), GR, GS, LR, or
LS.>

User:

The user can respond with one of the following inputs:

- a. G CR
- b. L CR
- c. R CR
- d. S CR
- e. GR CR
- f. GS CR
- g. LR CR
- h. LS CR

Option (a) selects Global Scale, (b) selects Local, (c) selects Rectangular, (d) selects Square, (e) selects Global and Rectangular, (f) selects Global and Square, (g) selects Local and Rectangular, and (h) selects Local and Square.

ERROR MESSAGES:

None

NEXT FRAME:

DFSDSP

OPTION

02 - PRINT ID'S

GENERAL DESCRIPTION:

This option prints on the line printer the ID number, class symbol, and unscaled x, y projection values of user indicated vectors. The user holds the light pen against any plotted class symbol (representing a vector), waits for the plot to respond to the selection, and then presses the light pen switch. (The plot responds to the selection by increasing the size of the class symbol which the light pen senses). All vectors which are currently plotted and whose display coordinates are equal to the display coordinates of the selected symbol are then output to the line printer in the form:

Vector ID	Class Symbol	Measurement X	Measurement Y
-----------	--------------	---------------	---------------

The user repeats this sequence as often as he likes and terminates the option through a keyboard response.

DIALOGUE:

System:

<LIGHT PEN VECTOR. TYPE <CR> TO ESCAPE.>

User:

CR User terminates the option with a carriage return when he has finished selecting vectors with the light pen.

ERROR MESSAGES:

None

The user should note that the option prints header information on the line printer prior to displaying the system dialogue message. If the message fails to appear, the user should insure that the line printer is on line.

NEXT FRAME:

DFSDSP

37-02-02

OPTION

03 - BLINK

GENERAL DESCRIPTION:

This option controls the display blink function allowing the user to cause all the vectors of any selected class to blink on and off when plotted. Once enabled, a class continues to blink over all other options in this frame, excluding the Select Basis option (10).

The user selects classes for blinking with the light pen. The frame option menu is temporarily destroyed and replaced by a list of class symbols. Each class symbol is preceded by a beta (β), indicating that the class is blinking, an epsilon (ϵ), indicating that the class has been eliminated, or a blank. The user moves the light pen over this list and an arrow keeps track of the last class symbol sensed by the light pen. When the user presses the light pen switch, action is taken on the class to which the arrow is pointing. If the class is not blinking, the blink is enabled and a β is displayed before the class. If the class is blinking, the blink is disabled and the β removed. (If the class is eliminated the attempted action will be ignored.) Once action has been taken on a class, the arrow must be moved to another class before any further action can take place. After moving the arrow, the user can reselect the previous class or any other class in the list.

DIALOGUE:

System:

< LIGHT PEN ACTIVE. TYPE: < / > TO CLEAR ALL, < CR > TO ESCAPE >

User:

The user can respond with one of the following inputs:

- a. / CR
- b. / CR CR
- c. CR

Option (a) disables the blink for all classes. Option (b) disables the blink for all classes, terminates the BLINK option, and restores the frame option menu. Option (c) terminates the BLINK option and restores the frame option menu.

ERROR MESSAGES:

None

NEXT FRAME:

DFSDSP

OPTION

04 - ELIMINATE

GENERAL DESCRIPTION:

This option allows the user to eliminate all vectors of any selected class from the display. Once a class is eliminated it remains undisplayed over all other options in this frame, excluding the Select Basis option (10). Since the elimination is purely a display function, scaling parameters and the paging scheme are not affected.

The user selects classes for elimination with the light pen. The frame option menu is temporarily destroyed and replaced by a list of class symbols. Each class symbol is preceded by an epsilon (ϵ) indicating that the class has been eliminated, a beta (β) indicating that the class is blinking, or a blank. The user moves the light pen over this list and an arrow keeps track of the last class symbol sensed by the light pen. When the user presses the light pen switch, action is taken on the class to which the arrow is pointing. If the class has not been eliminated, it is eliminated and a ϵ is displayed before the class. If the class has been eliminated, it is restored and the ϵ removed. (If the class is blinking, the attempted action will be ignored.) Once action has been taken on a class, the arrow must be moved to another class before any further action can take place. After moving the arrow, the user can reselect the previous class or any other class in the list.

DIALOGUE:

System:

< LIGHT PEN ACTIVE.TYPE: < / > TO CLEAR ALL, < CR > TO ESCAPE >

User:

The user can respond with one of the following inputs:

- a. / CR
- b. / CR CR
- c. CR

Option (a) restores all classes. Option (b) restores all classes, terminates the ELIMINATE option, and restores the frame option

menu. Option (c) terminates the ELIMINATE option and restores the
frame option menu.

ERROR MESSAGES:

None

NEXT FRAME:

DFSDSP

OPTION

06 - ZOOM

GENERAL DESCRIPTION:

This option allows the user to magnify any area of the displayed plot. When the option is selected a square appears on the display screen. The user manipulates the position and size of the square to define an area for magnification. Potentiometer 1 or Control Dial 1 controls the positioning of the square in the x direction, dial 2 controls the positioning in the y direction, and dial 3 controls the size of the square. The user defined area is then translated and expanded to fill the entire display coordinate space, rescaling all vectors that are within that area and excluding all that are not. The user can restore the original plot through the CHANGE SCALE option (01). Until then, the zoom effect remains active over all other options in this frame, except the Select Basis option (10).

DIALOGUE:

System:

< DIALS 1-3 ACTIVE. TO FREEZE BOX AND PROCEED TYPE < CR > >

User:

CR The user responds when the square defines the desired area of the plot.

ERROR MESSAGES:< ERROR: SELECTED RANGES $\leq \emptyset$ >

Indicates that the selected range is unplottable.

NEXT FRAME:

DFSDSP

OPTION

07 - DRAW BOUNDARY

GENERAL DESCRIPTION:

This option allows the user to draw a maximum of two, six segment boundaries on the displayed plot for the purpose of creating two space logic. The boundaries are drawn with the data tablet and stylus, and are retained over all other options in this frame, except for the SELECT BASIS option (10). Re-selection of the DRAW BOUNDARIES option automatically erases any previously drawn boundaries.

To draw a boundary, the user brings the attached stylus close to, but not touching the surface of the data tablet, activating a display screen cursor (a large plus sign), the position of which is dependent on the position of the stylus relative to the tablet surface. The user then fixes the initial point in the boundary by pressing the tip of the stylus against the tablet. A line segment is immediately drawn between the fixed point and the cursor such that the length and direction of the segment varies with movement of the cursor. The user terminates the segment and fixes its position by pressing the stylus against the tablet again. A new line segment is then drawn between the second fixed point and the cursor. This sequence continues until the user terminates the boundary through a keyboard response, or by completing six line segments.

The cursor disappears from the screen whenever the user takes the stylus out of proximity with the tablet. The adjustable line segment also disappears, but fixed line segments remain on the screen. Bringing the stylus back in proximity will restore the adjustable line, unless the user has terminated the boundary or the boundary has no fixed line segments. (Thus no boundary exists if the user deletes all of its fixed segments or removes the cursor after fixing only the initial point.)

Keyboard responses are ignored as long as the cursor is on the screen. When it is removed the user has four options: (1) Terminate the boundary (if a boundary is not terminated it is erased from the screen when the Escape option is selected), (2) Close Boundary terminates the boundary by drawing a line segment between the first and last fixed points in the boundary), (3) Delete Line (deletes the last fixed line segment from the screen. If that segment belongs to a terminated boundary, the resulting boundary is not considered terminated), and (4) Escape (erases any untermi-nated boundary and returns the user to the frame options).

After termination of the first boundary, all subsequent data tablet inputs are interpreted as belonging to a second boundary. After the second boundary is terminated, all subsequent data tablet inputs are ignored and the only options open to the user are Delete line and Escape.

DIALOGUE:

System:

< DATA TABLE ACTIVE. < t > = terminate boundary, < c > = CLOSE BOUNDARY,
< d > = DELETE LINE, < e > = ESCAPE. >

User:

The user can respond with one of the following inputs:

- a. t CR
- b. c CR
- c. d CR
- d. e CR

Option (a) terminates the boundary, that is closes it to all further data tablet input. (b) draws a line segment between the first and last point of the boundary and terminates it. (c) deletes the last line segment from the screen and if it belongs to a terminated boundary opens the boundary to further data tablet input. (d) erases any unterminated boundary and returns the user to the frame options.

ERROR MESSAGES:

None

NEXT FRAME:

DFSDSP

08 - RESELECT PAIR

GENERAL DESCRIPTION:

This option allows the user to reselect a class pair at the current pairwise logic node and display a new scatter plot consisting of the projection of the data from the two classes onto the two logic vectors associated with the pair. If the logic type for the new pair is two space logic, the boundaries associated with the logic are also drawn. This option gives the user the capability of changing the logic type for the selected pair to two space logic. Only the class data at the current pairwise logic node will be displayed.

DIALOGUE:

System:

< ENTER CLASS PAIR >

User:

The user enters two symbols from a list displayed on the VG.

System:

< DOT PRODUCT COMPUTATION IN PROGRESS >

Followed by:

< PAGING >

ERROR MESSAGES:

< NO VECTORS AVAILABLE >

Indicates there were no vectors in the data set residing at the current pairwise node.

< FILE ACCESS ERROR >

Indicates an error occurred attempting to access a file.

<PAIR CONTAINS BOOLEAN LOGIC >

Indicates the logic for the pair is Boolean logic. A scatter plot cannot be performed.

NEXT FRAME:

N/A

09 - EVALUATE

GENERAL DESCRIPTION:

This option creates two space logic based on the boundaries that are drawn on the scatter plot. The logic is a method of classifying vectors according to the side of a boundary on which they fall. This option evaluates the current data set against the logic and produces a confusion matrix. The user can then determine if the logic is adequate for classifying purposes and save or reject it.

DIALOGUE:

System:

(If there is only one boundary, begin with 4)

< SELECT BOUNDARY WITH LIGHT PEN >

User:

User touches a boundary with the light pen. The light pen switch is not active.

System:

(Marks the selected boundary with an x)

User:

User touches a boundary with the light pen. If the switch is not active, repeat 2. If active, proceed to 3.

System:

< BOUNDARY SELECTED >

(May disappear too rapidly to be seen)

Followed by:

(Marks a boundary with an x. Displays a plus sign cursor)

< USE DIALS TO MOVE CURSOR TO CONVEX SIDE OF MARKED BOUNDARY,
THEN TYPE CR. >

User:

(After moving cursor)

Carriage Return

System:

(Labels the region that contained the cursor as 1)

< SELECT SYMBOL FOR REGION 1. (SYMBOLS: A, B, *) >

(where A and B represent the Fisher pair and * exists only if
there is more than one boundary. *=reject region)

User:

a. A and CR

b. B and CR

c. * and CR (only if there is more than one boundary)

System:

(Only if there is more than one boundary. Otherwise go to 9.

Marks second boundary with an X. Displays plus sign cursor).

< USE DIALS TO MOVE CURSOR TO CONVEX SIDE OF MARKED BOUNDARY, THEN
TYPE CR. >

User:

(after moving cursor)

Carriage Return

System:

(Labels the region that contained the cursor as 2)

< SELECT SYMBOL FOR REGION 2. (SYMBOLS: C,*) >

(where C represents the symbol not selected in 5)

User:

- a. C and CR
- b. * and CR (reject region)

System:

< LOGIC COMPUTATION IN PROGRESS >

Followed by:

< WAIT - EVALUATION IN PROGRESS >

Followed by:

< ENTER V-VG L-LINE PRINTER B-BOTH >

User:

The user selects the device for listing the confusion matrix.

System:

< ENTER A-ACCEPT R-REJECT >

User:

The user types A to accept the two space logic, or R to reject the logic.

System:

< ANOTHER CLASS PAIR? (Y) >

User:

The user types a Y to request a scatter plot of another class pair.

ERROR MESSAGES:

< LOGIC FILE ERROR >

Indicates an error occurred attempting to access the logic file.

NEXT FRAME:

PWMOD

SECTION 38

EDIT NAME AND SAVE FRAME

Frame Name: NASFRM

Call Sequence: 09-04

NAME AND SAVE FRAME

GENERAL DESCRIPTION:

This frame allows the user to manipulate the arbitrary vector file. The arbitrary vector file contains arbitrary basis vectors which can be used in OLPARS displays and logic design. The maximum number of vectors that can be stored is 42.

<u>OPTIONS</u>	<u>DESCRIPTION ON PAGE</u>
00 DISPLY ENTRIES	38-00-01
01 INITIALIZE N&S	38-01-01
02 DELETE VECTOR	38-02-01
03 PRINT VECTOR	38-03-01
04 KEYBD INPUT	38-04-01
05 Blank	
06 "	
07 "	
08 "	
09 "	
10 "	
11 "	
12 "	
13 RET OLPARS FRM	20-1
14 RET INIT FRM	2-1
15 Blank	

NASFRM

09-04

OPTION

00 - DISPLY ENTRIES

GENERAL DESCRIPTION:

Information associated with the basis vectors stored in the arbitrary vector file is displayed on the VG display screen. The information displayed for each basis vector stored, includes its entry position in the file, a 6 character name, and the vector dimensionality.

DIALOGUE:

System:

Lists on the VG display screen information associated with the basis vectors stored in the arbitrary vector file.

ERROR MESSAGE:

None

OPTION

01 - INITIALIZE N&S

GENERAL DESCRIPTION:

This option allows the user to delete all of the basis vectors stored in the arbitrary vector file.

DIALOGUE:

System:

Lists on the VG display screen information associated with the basis vectors stored in the arbitrary vector file (See DISPLY ENTRIES).

<<X> TO DELETE FILE, <CR> TO EXIT>

User:

Capital "X" "CR" to delete all vectors stored in the arbitrary vector file.

"CR" return to FRAME.

System:

Lists on VG display screen information associated with the basis vectors stored in the arbitrary vector file.

ERROR MESSAGE:

< FILE ERROR >

System I/O error, check for hardware error.

NASFRM

09-04

OPTION

02 - DELETE VECTOR

GENERAL DESCRIPTION:

This option allows the user to eliminate selected basis vectors from the arbitrary vector file.

DIALOGUE:

System:

Display on the VG display screen information associated with the basis vectors stored in the arbitrary vector file.

< ENTRY NO. TO BE DELETED >

User:

For each basis vector that is to be deleted from the arbitrary vector file enter the associated entry number (Integer "CR"). When all of the vectors that are to be deleted from the file are selected, type in a "Ø" "CR" to continue.

System:

<DEL IN PROG >

System now deletes the selected vectors from the arbitrary vector file. After the deletion is completed, re-display the information associated with the stored arbitrary vectors.

ERROR MESSAGE:

<FILE ERROR >

System I/O error, check for hardware error.

38-02-01

OPTION

03 - PRINT VECTOR

GENERAL DESCRIPTION:

This option outputs on the line printer the values of a selected vector stored in the arbitrary vector file. Also printed is its dimensionality and associated 6 character name.

DIALOGUE:

System:

Displays on VG display screen, information associated with the basis vectors stored in the arbitrary vector file.

< ENTRY NO. >

User:

Type in entry number (Integer "CR") associated with the basis vector that is to be printed out.

System:

Print on the line printer the basis vector, dimensionality, and 6 character name.

ERROR MESSAGE:

< ERROR >

User selected an entry no. that is not in the arbitrary vector file.

OPTION

04 - KEYBD INPUT

GENERAL DESCRIPTION:

The user may input through the VG keyboard an arbitrary basis vector. This vector is stored in the arbitrary vector file. The vector can then be used as a basis vector for display or logic design.

DIALOGUE:

System:

Lists information associated with the basis vectors stored in the arbitrary vector file on the VG display screen.

< DIMENSION OF VECTOR, 100 MAX >

User:

User inputs the dimensionality (Integer "CR") of the basis vector that is to be input. The dimension limit is 100.

System:

< 6 CHARACTER NAME >

User:

User inputs a 6 character name that is to be associated with the input vector.

System:

For each dimension in the input vector

< VECTOR ELEMENT, 12 CHAR. MAX >

User:

For each dimension in the input vector, type on the VG keyboard a 12 character number and "CR". The format of the number is in either F or E format.

System:

System prints on the line printer the vector values, dimensionality, and 6 character name associated with the vector just typed in.

ERROR MESSAGE:

<CONVERSION ERROR, TRY AGAIN 12 CH. >

The last dimension inputted from the keyboard caused a conversion error, re - type dimension value and continue.

<FILE ERROR >

System I/O error, check for hardware error.

<FILE FULL >

Arbitrary vector file has 42 entries. Go to delete vector option to make room.

APPENDIX A

GETTING WPS ON THE AIR

The following steps are necessary to get WPS on the air:

- (1) Mount the RK05 disk pack to unit 0
- (2) Mount the system disk (RP02 or RP04) to unit 0
- (3) Boot the DOS monitor from the RK05 disk.
 - (a) halt processor at console
 - (b) load address 777110 (or the proper address for your loader)
 - (c) enable - start
- (4) Log in
- (5) \$RUN WPS

APPENDIX B
WPS - WAVEFORM TAPE FORMAT

The first record on the tape is a 32 word header record in the following format:

	15	14	13	0
Word 1	R		F	
Word 2	T1		NN	
Word 3	T3		T2	
Word 32	0		T60	

Fig. B-1 Tape Header

where Word 1 specifies the digitization rate of the data on the tape. F is the frequency (0 - 16383) and R designates the units of frequency; 0 = Hz, 1 = KHz, 2 = MHz, 3 = HZ/1000. Some examples of a digitization rate (also referred to in this document as Sample Rate or SR) in R-F format are:

17 MHz: R=2, F=17
 1 MHz: R=2, F=1 or R=1, F=1000
 20 KHz: R=1, F=20
 10 KHz: R=1, F=10 or R=0, F=10000
 3 Hz: R=0, F=3 or R=3, F=3000
 1.2 Hz: R=3, F=1200

NN is the number of nodes or classes of data on the tape, and T1 - T60 are 60 ASCII characters of textual information describing the

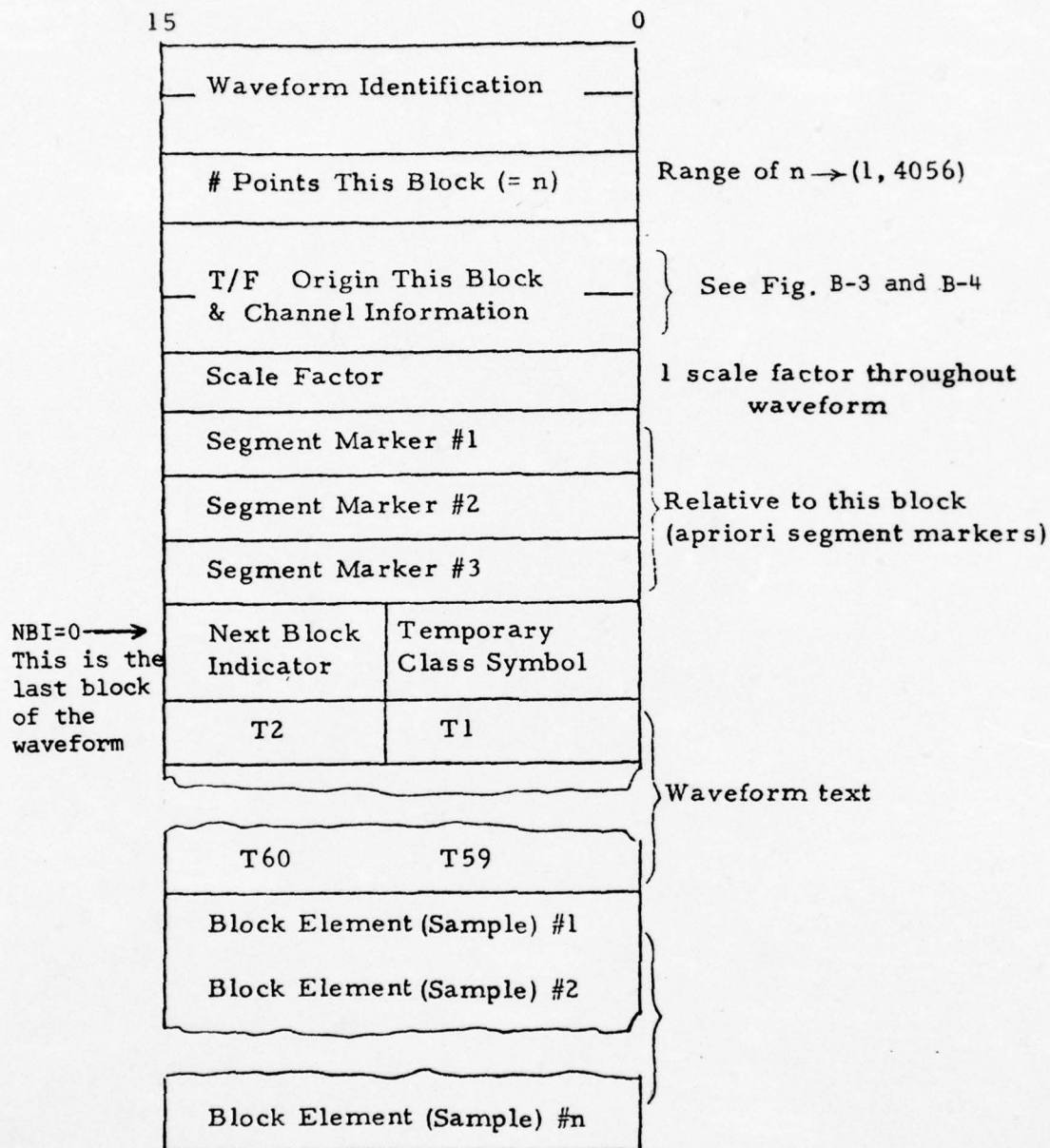


Figure B-2 Waveform Header

data or the source of the data on the tape.

The header record is followed by NN number of files; each file is made up of some number of waveforms; an "end of file" mark indicates the end of each file. Any one waveform consists of one or more physical tape records (blocks). A block is constructed as follows:

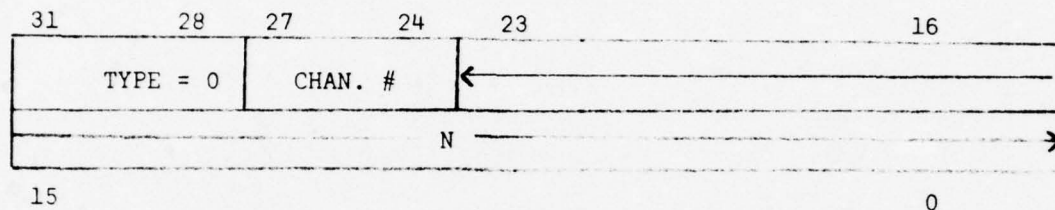


FIGURE B-3 ORIGIN/CHANNEL FORMAT FOR TIME DOMAIN WAVEFORM

As shown in Figure B3 above, TYPE = 0 indicates a time domain waveform. N is the ordinal number of the first point in the block, with respect to the beginning of the wave. A sample waveform showing the block N's is below:

Example #1

$N_0 =$		$N_1 =$		$N_2 =$		$N_3 =$		$N_4 =$	
0		501		1001		2001		2101	
BLOCK#1		BLOCK#2		BLOCK#3		BLOCK#4		BLOCK#5	

FIGURE B-4 A SAMPLE WAVEFORM EXPLAINING THE USE OF N. (EXAMPLE #1)

There are 500 points in the first two blocks, 1000 points in block #3, 100 in block #4, and to find the number of points in block #5 one would check the third word in the header.

In order to indicate the starting time of the waveform, the value of N stored in the very first header (N_0) is obtained as $N_0 = T_0 * SR$, where T_0 = Starting Time and SR = Sample Rate. The value of N_0 , however, does not affect the other N 's in the succeeding blocks. Such may be the case below in example #2:

Example #2

$N_0 =$		$N_1 =$		$N_2 =$		$N_3 =$		$N_4 =$	
30000		501		1001		2001		2101	

FIGURE B-5 SAMPLE WAVEFORM WITH NON-ZERO START TIME. (EXAMPLE #2)

The number of points in each block of example #2 is the same as in example #1. However, the starting time of the waveform in example #2, given $SR = 1000$, is 30 seconds ($T_0 = N_0/SR$). The starting time of the waveform in example #1, where $N_0=0$, is 0 seconds.

In order to indicate negative starting times as well, N_0 is stored as a 24-bit two's complement number, e.g. $100,000 = 001 - 103240_8$ and $-100,000 = 376 - 674540_8$

The ranges of N are as follows:

$$-8388308 \leq N_0 \leq 8388307 \quad (= 2^{23} - 1)$$

$$1 \leq N_i \leq 8388307$$

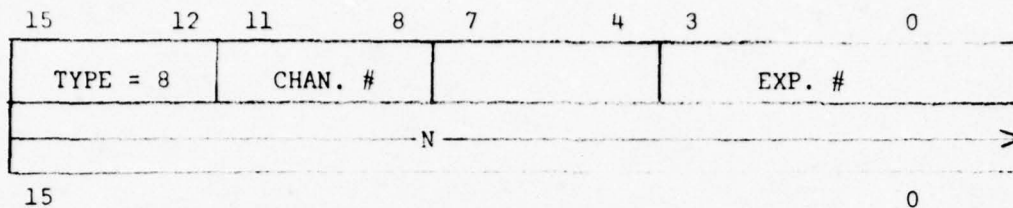


FIGURE B-6 ORIGIN-CHANNEL FORMAT FOR FREQUENCY-DOMAIN WAVEFORM

For a frequency domain waveform, the number of points in the window transformed is indicated by its power of 2 (EXP. #). N is determined by the frequency represented by the first point in the block: $N = \text{FRQ}/\text{FR}$, where FR (frequency resolution) = $\text{SR}/2^{\text{EXP. \#}}$. In other words, N is the ordinal count of the first point in the block, relative to the beginning of the window.

Note the difference between the ordinal count in the time domain and that in the frequency domain. In time domain, the count is relative to the beginning of the stored portion of the waveform. If the front of the waveform is truncated, the ordinal count of the remaining points is changed because they are relative to the new beginning of the waveform. In the frequency domain, the ordinal count is from the beginning of the "window". Thus, even if the front of a frequency domain waveform is truncated, the ordinal counts do not change.

Note also that in time domain, N_0 may be set arbitrarily to reflect an arbitrary start time. The frequency domain, N_0 may not be set arbitrarily.

Data is recorded on 10 $\frac{1}{2}$ inch reels with tapes of following specifications: 9-track; 16 bit/word; max 4096 word/record; 800 bpi.

The machine used at RADC is a DEC PDP 11/45.

For inputting a WPS formatted tape into the WPS system, see OPTION 00 in INPDTA (INPUT DATA) frame on page 3-00-01 .

APPENDIX C

DATA TYPES

1. System Directory:
 - 0 - Frames
 - 1 - Programs
 - 2 - Core-image files

2. Waveform and Vector data:
 - 63 - Waveform data
 - 13 - Vector data
 - 14 - Statistics on vectors

3. Text files:
 - 62 - Tree text

4. Segmentation:
 - 90 - Marker Tree

5. PARLAN files:
 - 83 - Source program
 - 73 - PARLAN intermediate file
 - 74 - Intermediate file
 - 79 - Generated code
 - 84 - Intermediate file

70 - Intermediate file

5 - Intermediate file

All files except 83 and 79 are not visible to user.

6. OLPARS files:

20 - Logic tree file

21 - Class symbol file

22 - Logic file

88 - Scratch

17 - Name and Save file

APPENDIX D

OLPARS - VECTOR TAPE FORMAT

The only input to the 11/45 OLPARS is through a 9 track tape, which was generated on the 11/45.

The tape can have any number of trees having any number of nodes. (See Vol. 1 for system limits).

Each tree consists of a header record followed by a file for each class. The end of the file is designated by an "end of file" marker. To signify the end of the tape an extra "end of file" marker is written onto the tape.

TREE HEADER

The tree header consists of a 32 word physical record. Word 1 contains the dimensionality of the data set and word 2 contains the number of nodes in the tree. Both words are 16 bit integers. Words 3 to 32 consist of a 60 ASCII character text associated with the tree. See Figure D-1.

Word 1	DIM.
2	# of Nodes
3	T
	E
3	X
	T
32	

FIGURE D -1 Tree Header

NODE HEADER

For each node in the tree there is a 33 word physical record associated with it. This record is the first record of the file. Word 1 contains the **number 13**. Word 2 contains the number of vectors in the node, and word 3 contains the number of words used to store each vector and vector header. The previous numbers are 16 bit integers. Words 4 to 6 contain a 6 character node name stored in ASCII. Words 7 to 37 contains a 60 ASCII character text associated with the node. (See Figure D -2).

Word	1	13.
	2	# Vectors
	3	# words/vector
	4-6	Node name
	7-37	Test

FIGURE D -2 Node Header

VECTOR DATA

Each vector in a node consists of the vector values and an 11 words header. Each vector with its header is a physical record. The vector values can be either 16 bit integers or 11/45 floating point numbers. (Note: Tape must have only one type of vector value).

The 11 word header contains a 32 bit integer ID (word 1,2), the length of the vector not including its header in words (word 3), and the number 1000000₈ in word 11. (See Figure D -3).

The maximum dimensionality is 100.

Word	1	ID
	2	
	3	For # words/values
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	1000000 ₈
	12	Vector Values

FIGURE D-3 Vector Record

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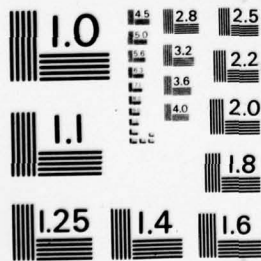


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